

LOW-COST LAPTOPS

EXPERT REVIEWED:
NINE BARGAIN NOTEBOOKS
STARTING FROM JUST \$299

Chromebook

2016

Jan 2016
Issue 424

YOUR EXPERT

GUIDE TO TODAY'S

**BACK TO
SCHOOL+WORK
TECH SPECIAL**

ESSENTIAL GEAR &
GADGETS TO GET
PRODUCTIVE IN 2016!

BRILLIANT HOLIDAY HACKS!

GET SET UP FOR 2016: AWESOME TECH PROJECTS
YOU CAN DO IN YOUR DOWNTIME & REAP THE
BENEFITS FROM ALL YEAR ROUND!

INCLUDING:

- IMPROVE YOUR WI-FI
- INSTALL A SMART LOCK
- UPGRADE TO AN SSD
- MAKE A RETRO GAME PC
 - SET UP A VPN
 - RE-USE AN OLD SMARTPHONE

THE US\$5 PC: RASPI ZERO

Makers rejoice: It's more powerful than the original and less than 1/4 the price! Full review on page 26!

LATEST TECH & GEAR TESTED

- Fastest-ever Wi-Fi 2167Mbps router
- Dell's MacBook Air killer gets upgraded
- First Windows 10 Mobile smartphone

MORE GREAT TECH TUTORIALS!

- Unlock Windows 10's God mode
- Wrangle back control from Windows Update
- Get gaming on Linux



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VPN



50x

VPN

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- ✓ Two USB ports for 3G/4G USB modems, network printer, storage and USB thermometer
- ✓ Integrated IEEE 802.11ac wireless Access Point; dual band; up to 1300Mbps throughput
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Vigor2925ac / Vigor2925Vac

Dual Gigabit-WAN Broadband VPN Firewall Router

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- ✓ Five Gigabit LAN ports with multiple subnets and 50,000 NAT sessions
- ✓ Two USB ports for 3G/4G USB modems, network printer, storage and USB thermometer
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- ✓ VoIP (2 x FXS and 1 x FXO Line Port) for Vigor2925Vac



2x

VPN

Vigor2132ac

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VigorAP 910C

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APC is published by Future Publishing Australia.

Distributed in Australia and NZ by Network Services.

Printed by Webstar

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exclusive software

HOW TO DOWNLOAD YOUR FREE FULL-VERSION PROGRAMS

ISSUE 674 JANUARY 2013



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Goodbye to the disc

APC's editor discusses where (and why)
the cover disc has gone.

Many readers noticed that, as of last month, the APC disc has been discontinued. There are a few reasons for this that are worth explaining, so I've used this month's editorial to try to answer why we've made this change.

After including a disc for almost two decades, we had the production process working like a well-oiled machine, but last month, recent changes at our disc supplier (who we've been using for over a decade) unexpectedly delayed their ability to press the disc. Despite extending the deadline once, twice, then again (and then pushing the on-sale date of the magazine from Thursday to the following Monday), they never turned up at our printer. With all the magazine pages printed and sitting waiting to be bound, we ultimately had to pulp an entire 16-page section of the magazine (adding up to hundreds of thousands of pages) so that we could replace the disc contents page explaining why there was no disc. Needless to say, we were pretty peeved.

But as we outlined last month, the discontinuation of the disc has been a long time coming and we took last month's kerfuffle as sign that it was time to rip off the band-aid, so to speak. While there's no doubt that some readers still greatly value the disc, optical media's heyday has well and truly passed. We live in the age of

on-demand streaming TV and movie shows, and watching just one of the latter will typically eat up many more megabytes than you would when downloading the exclusive software we included on the disc.

It's also better from an environmental perspective. The economics of selling magazines means that more copies need to be printed and distributed than are often sold. Paper can be easily recycled and turned back into paper again, but the metal layer in DVDs and CDs makes this a harder process for optical media, requiring more expensive machinery that's not as widely available in Australia.

Of course, we'll still be providing free full-version software for our readers as downloads – something we implemented earlier in 2015. You can find instructions on grabbing this month's applications on page 6, right after the contents pages.

Our farewell to the disc is undeniably a little bittersweet, but it definitely deserves our thanks for its many years of reliable service. ■



DAN GARDINER
EDITOR-IN-CHIEF
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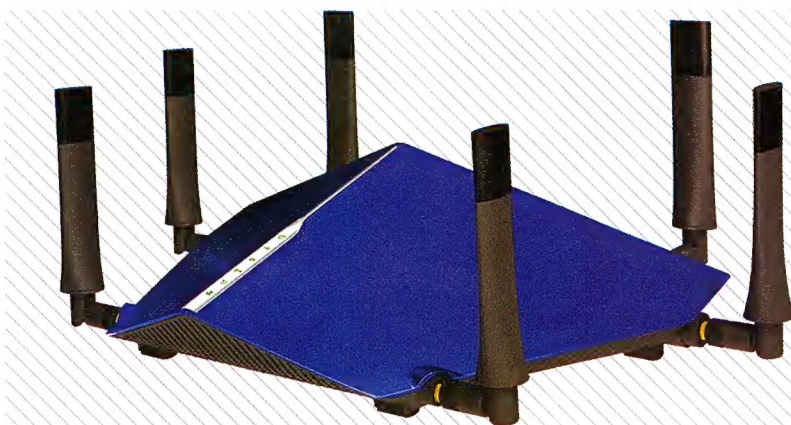
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exclusive software

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ISSUE 424, JANUARY 2016



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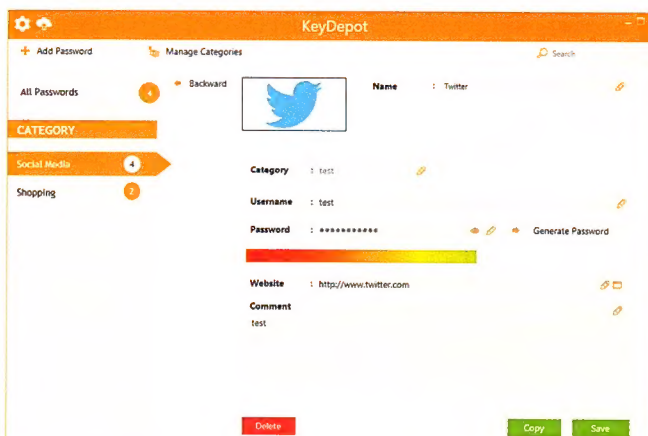
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technotes

» INSIDE APC



Inside APC

Find out all about APC's editorial policies, test practices, how to read the benchmark results and more.

APC is Australia's oldest consumer technology magazine – having been consistently in print for over 35 years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer – it's in our name, after all – the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech too, from smartphones and apps to peripherals, accessories, online services and beyond. We have two main goals: to track down the best of modern tech and also to help our readers make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And like you, APC's journalists want to know what's good in tech – no matter what platform it resides on.

INDEPENDENT REVIEWS

Championing technology doesn't mean we're unrelenting yes-men, however, and APC aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three.

As a matter of policy, reviews published in APC are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an APC reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

LABS TESTING

Despite being a small magazine with limited resources, APC still strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance, gaming and battery life.

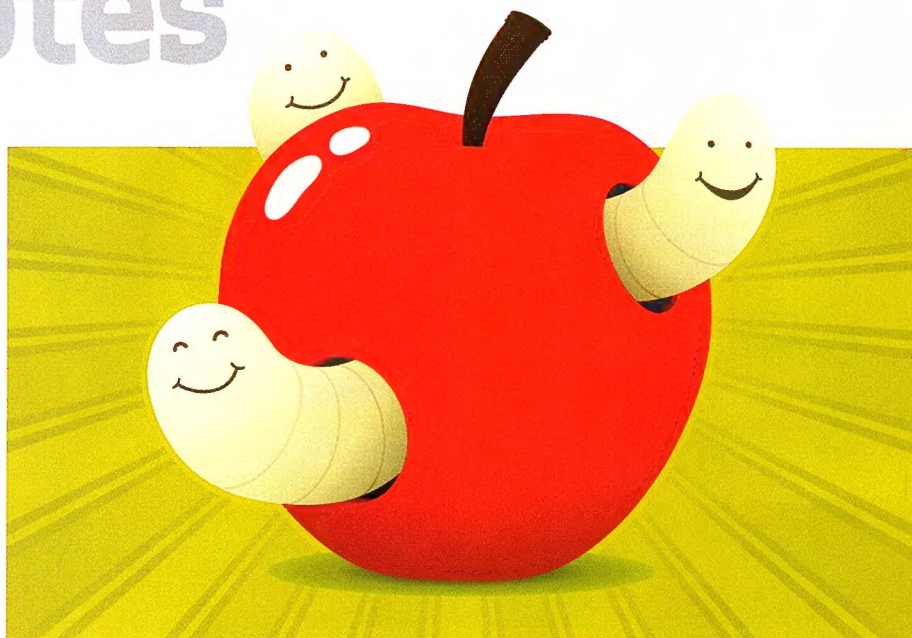
In most cases, for the benchmark results published in APC, you can assume that higher is better. There are certain tests that deviate from this rule and where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter are our preference due to their ease-of-readability, but tables are more compact, so we use these in cases where thoroughness is preferred.

Village Roadshow's war on piracy kicks off

Wants to get this anti-piracy show on the road.

Fed up with internet piracy, the Australian media company Village Roadshow has announced its intention to take advantage of the Australian Government's new anti-piracy laws by submitting an application to the Federal Court. The legislation, dubbed Copyright Amendment (Online Infringement) Bill 2015, allows rights holders to apply for an injunction against overseas websites, like The Pirate Bay, that facilitate copyright infringement in Australia. Piracy websites that are successfully hit with an injunction will be replaced by a landing page notifying visitors that the site has been blocked by the court, though one has to imagine how effective this approach would be when sites like The Pirate Bay and Kickass Torrents change domains and hosting companies on what seems like a weekly basis. Though the legislation was passed back in June, Village Roadshow will be the first rights holder to submit an application under the laws, which is a small step towards the promise co-founder Graham Burke made back in August, in which he said "we will sue people". **Stephen Lambrechts**



Virus-makers targeting Macs in 2016

Or so say antivirus vendors...

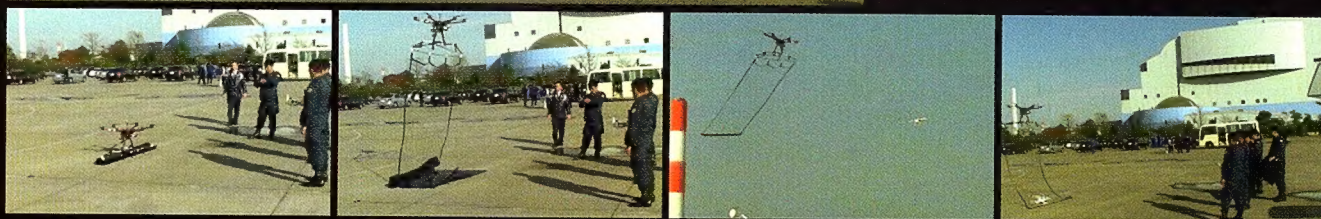
Users of Apple computers have had it pretty good for a long while when it comes to avoiding viruses, as cybercriminals have traditionally put their efforts into writing malware aimed at Windows PCs. But as the market share for iOS and Mac OS X continues to grow, so does the target on Apple's back — according to Symantec, malware numbers aimed at iOS products have doubled over the last year, and the number of threats to Mac computers has also risen. Security firm FireEye is predicting that virus-makers are going to go after Apple hard in 2016, specifically pointing out the service Apple Pay as an expected target. Symantec researcher Dick O'Brien has warned Apple users that they "can no longer be complacent about security, as the number of infections and new threats rise". Symantec's research states that the number of OS X computers infected with malware in just the first nine months of 2015 was already seven times higher than the entire previous year. **Stephen Lambrechts**



Swatting drones

Police in Japan will use drones with nets to take down other drones.

No, it's not a scene from *Ghost in the Shell* — police in Japan are implementing the use of interceptor drones to catch other drones suspected of foul play. The move comes after a drone carrying sand contaminated with radiation was found on the roof of the Prime Minister's office. The interceptors will be equipped with a camera and large net. **Stephen Lambrechts**



Adobe wants you to stop using Flash

Encourages users to move on to greener pastures.

Though it's been slowly becoming obsolete for the better part of a decade, Adobe is finally ready to let go of Flash, advising users to "build with new web standards", such as the open standard HTML5. Adobe's first step in doing so involves the retiring of the 'Flash' name, renaming the application Animate CC, positioning it instead as a general animation tool.

Stephen Lambrechts

Future Internet to be transmitted by light

Li-Fi could be the future of data transmission.

Could the Internet of the future transmit through light sources? Several university researchers and high-tech start-ups are currently working on "visible light communication" technology that would allow an LED light source to transmit data at 100 times the speed of Wi-Fi. It's been estimated that the Li-Fi market will be worth approximately \$8.5 billion by the year 2020.

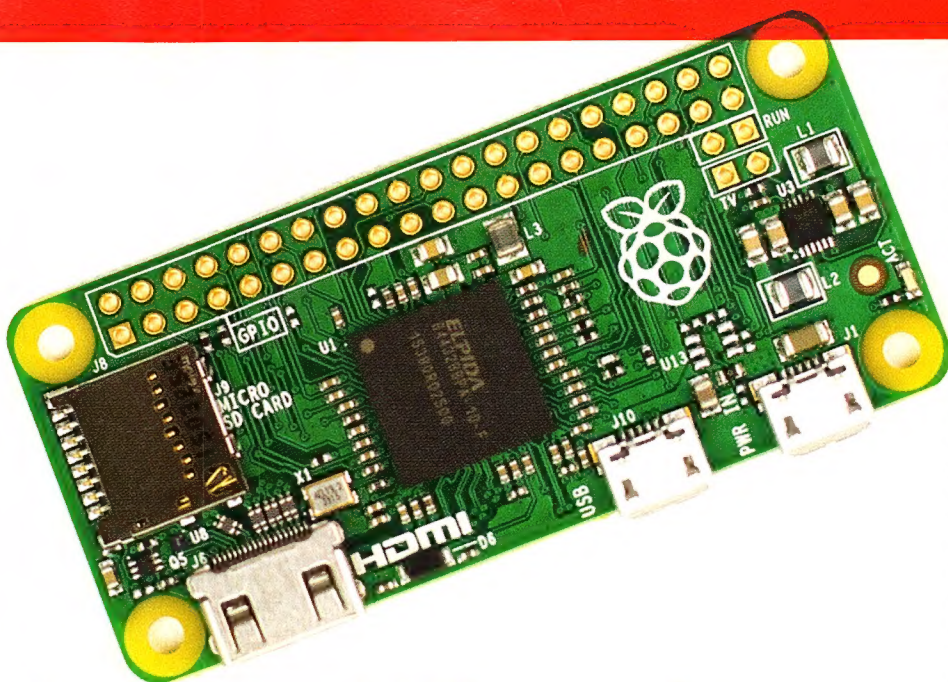
Stephen Lambrechts

Anonymous vows to take down ISIL

But is the hacker group doing more harm than good?

Actions by hacking group Anonymous has already lead to 5,500 pro-ISIL Twitter accounts being shut down (it involved flooding said accounts with videos of Rick Astley's *Never Gonna Give You Up*). Not a bad first step, and it comes after the 12-year-old group said it "will launch the biggest ever operation" against ISIL, according to transcripts of a video on YouTube. However, security agencies say that they rely on ISIL members being active and having active social media accounts so that they can track would-be terrorists, monitoring them rather than shutting them down. This is a tactic employed by GhostSec, who relied on Twitter's open platform to track extremists. With those accounts now deactivated, ISIL members have taken to encrypted messaging sites such as Telegram. GhostSec's site says it is dedicated to eliminating "the online presence of Islamic extremist groups such as Islamic State [and others] in an effort to stymie their recruitment and limit their ability to organise international terrorist efforts".

Paul Taylor



Surprise! Ultra-cheap RaspberryPi model released, costs US\$5

New Pi Zero mini-PC is ideal for streaming, coding and much more.

The Raspberry Pi Zero is the latest model in the DIY computer range, and it's the smallest one yet. For approximately AU\$7, the motherboard packs a Broadcom BCM2835 CPU running at 1GHz, backed with 512MB of LPDDR2 SDRAM, complete with a microSD slot, mini-HDMI port (allowing for 1080p video output at 60fps) and micro-USB sockets, though you still have to provide your own case. Because it's so new, you may have to wait a little while for cases to become available, and it's unlikely it'll fit into existing cases — the unit is half the size of the Model A+. Raspberry Pi was heralded as being ideal for schools to teach kids how to code using inexpensive hardware, though the wider community has found out that the low-power devices are very robust at streaming media. Grab an OS (there are lots available), a microSD card and a USB Wi-Fi dongle, and you can stream media across your network for well under \$100. Check out our full review on page 26!

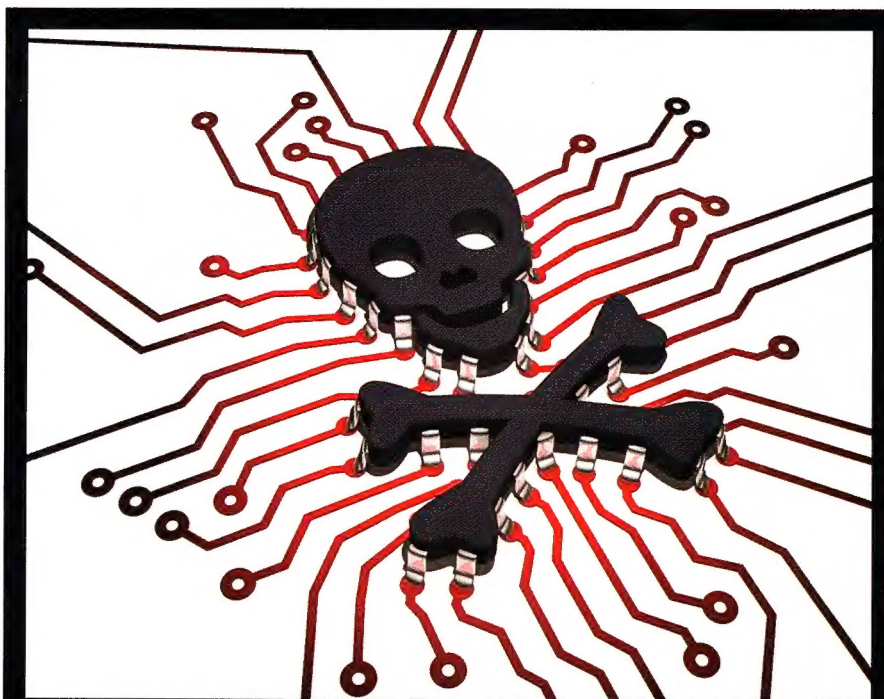
Paul Taylor

Tech giants say weakened encryption would "help the bad guys"

IT firms respond in the wake of the Paris attacks to calls from governments to allow back doors to encrypted data.

More than 60 tech companies — including Facebook, Samsung, Microsoft, Apple and Google — have joined together to reject calls from regulators to weaken encryption tools used in industries such as banking and transport. Governments from around the world have debated about the need for 'back door' access to encrypted data in the aftermath of the terrorist attacks in Paris in November this year, so that security services could monitor communications. Creating weakened encryption would be "exploited by the bad guys", says the Information

Technology Industry Council's chief executive, Dean Garfield. "We deeply appreciate law enforcement's and the national security community's work to protect us, but weakening encryption or creating back doors to encrypted devices and data for use by the good guys would actually create vulnerabilities to be exploited by the bad guys, which would almost certainly cause serious physical and financial harm across our society and our economy. Weakening security with the aim of advancing security simply does not make sense." Paul Taylor



\$420-\$720

THE AVERAGE AMOUNT AUSTRALIANS PAY OUT IN A RANSOMWARE ATTACK.

Norton Security's Insights Report for 2015 recently revealed that, over the course of this year, four million Australians have been victims of cybercrime amounting to an estimated total cost of \$1.4 billion. According to Mark Gorrie, Norton by Symantec's Pacific director, ransomware attacks have become more prevalent over the past year, outpacing less-sophisticated phishing attacks. After a thousand Australians were included in a 17,000 person global survey, the report found that each Aussie affected by cybercrime lost 14 hours and \$325 from a successful attack, with the average ransomware recovery cost averaging between \$420 and \$720.

72 2/3rds

HOW MANY CORES INTEL'S FLAGSHIP 2016 DESKTOP CPU COULD HAVE.

Intel has a new Xeon Phi chip codenamed Knights Landing. Once limited to inclusion in only the world's most powerful supercomputers, this 72-core processor with over eight billion transistors is about to be made available on a new range of PC workstations, and will more than double the 1.2 teraflops of existing Xeon Phi workstations during peak performance. The chip will include 16GB of internal memory, which is connected in a way to facilitate five times the bandwidth of DDR4 RAM.

THE NUMBER OF USERS WHO TURNED OFF THEIR AD BLOCKERS WHEN CONFRONTED WITH THE CHOICE OF PAYING INSTEAD.

Media mogul Axel Springer, the man behind German publication Bild — and he also recently acquired a controlling-share of Business Insider — took a stance on web ad-blockers, stopping Bild readers from visiting the site while using one. In October, Bild gave site visitors using ad-blocking software a choice: either switch it off, or sign up for a monthly subscription. Springer's heralded the move a success: not only did two-thirds of users running ad-blockers turn them off in the first two weeks, the total proportion of non-paying, ad-blocking visitors dropped from 23% into the single digits — giving the German company an extra three million page-views per month.

200 THOUSAND

THE NUMBER OF HITS ON YOUTUBE A CONVICTED SOFTWARE PIRATE NEEDS TO GET IN ORDER TO AVOID COURT-ORDERED FINES.

Czech Republic resident Jakub F was taken to court by international software advocate the Business Software Alliance, in response to years of unauthorised uploading of copyrighted software to various online forums. In September of last year, Jakub was found guilty and was given a three-year probationary period, after which the judge would sentence him based on his level of rehabilitation. However, a number of large companies, including Microsoft, further pursued him for damages that totalled US\$373,000. Unable to pay these damages, Jakub and the companies agreed to an unorthodox solution: Jakub could star in an anti-piracy film instead... on the condition that his channel gets more than 200,000 views. At the time this issue went to print in mid-December 2015, he'd amassed 1,131,588 views already.

23 THOUSAND

THE NUMBER OF AUSTRALIAN CHILDREN'S ACCOUNTS INVOLVED IN THE VTECH HACK.

Hong Kong-based e-learning manufacturer and software developer VTech revealed that it was hacked in November of last year, putting the account info of its five million global account holders in the wrong hands. Of that number, 23,000 children's and 18,000 adults' accounts have been compromised and although these kid's accounts are unlikely to contain any critical financial details, the hacker claiming responsibility for the breach worryingly stated that access to children's headshots and unencrypted full chat logs were available.

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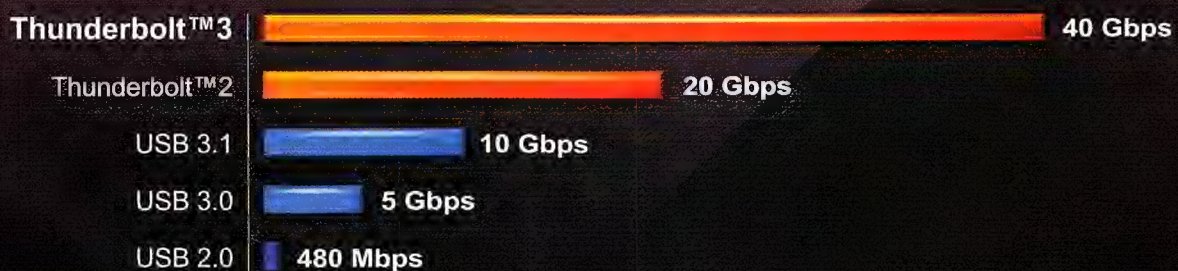
Support for Thunderbolt™ 3 on the GIGABYTE GA-Z170X-Gaming G1, GA-Z170X-Gaming GT, GA-Z170X-Gaming 7 motherboards opens up a world of new possibilities thanks to the increased bandwidth that it provides. Users can download the updated firmware today to enable support on their motherboard.



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technotes

» GEAR WE WANT

MARLEY LIBERATE BT

\$140 | WWW.THEHOUSEOFMARLEY.COM.AU

With its subdued grey canvas exterior and metal polka-dot faceplate, the Liberate BT is perhaps a little less distinctive than some of the other speakers that emanate from the hemp-infused Marley brand, but look a little closer and you'll recognise a familiar logo etched into the rear wooden panel and the company's trademark recycled-fibre fabric. Weighing only 390g, this battery-powered speaker fits squarely into the ultraportable category, yet its tiny pyramid-shaped design packs a reasonable sonic punch. The audio quality is excellent for the price and the 3400mAh battery can keep the music blaring for up to eight hours. **JB**



FOSSIL Q FOUNDER

US\$275 | WWW.FOSSIL.COM

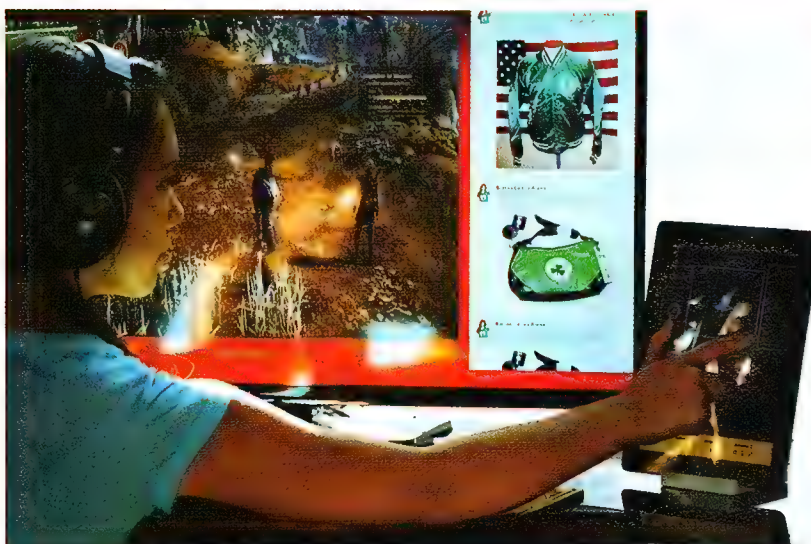
With the Moto 360, the LG Urbane and the more recent Samsung Gear S2, this year has seen a lot of competition emerging in the round-faced smartwatch category. But Texas-based fashion and accessories maker Fossil is still keen to throw its own smartwatch onto the (round) table, and if the company's recent acquisition of wearables-brand Misfit is anything to go by, then it might actually be a contender. Unfortunately, the Fossil Q Founder seems to suffer from the same 'flat tyre' cut-off display design as the Moto 360, but at least it looks good – still a rare quality among today's smartwatches. **JB**

HOVERBOARD

FROM \$4,170 | WWW.HOVERBOARD.COM

With 2015 the year of Marty McFly and *Back to the Future* Day, we guess it's fitting that someone made a hoverboard. Let's get one thing straight though: Hoverboard is not a real hoverboard, it's actually a skateboard with a single, central wheel. But wait! It looks like you're floating from the front, and it can play music and light up in different colours. What more do you need? And why are we excited about this not-hoverboard? All but the most basic model come with sonar sensors to keep Hoverboard level and parallel to the ground, which its creators claim gives the impression of levitation for riders. It may not be an actual hoverboard, but it looks like a great bit of fun in its own right. It'll be available from July 2016.





SKREENS NEXUS

FROM \$375 | WWW.SKREENS.COM

We're a multitasking bunch when it comes to tech, but we're very often doing different things on different gadgets, splitting our attention between them. The Skreens Nexus seeks to address this by enabling multiple devices to display on one screen via HDMI — and you can easily control it all from your iPad. Given the increasing resolutions of screens these days, it makes a lot of sense to have everything right in front of you. So you can have your Apple TV, a Twitter feed, your work and even a games console all up on the same screen, letting you keep tabs on it all without switching to another device. We also think the iPad control system looks like a great idea. It reportedly starts shipping in March 2016.

SKYBUDS

ABOUT \$415 | WWW.SKYBUDS.COM

While there are wireless earphone sets out there, most are so clunky you look like you're some sort of human-cyborg hybrid. Not so with Skybuds — they're sleek and discreet, and you can even match them to the colour of your iPhone (they're available in three variants: silver, grey and gold). What's with all the hype? When it comes out in May 2016, you won't just get the earphones — Skybuds also come with a charging case for your iPhone. From the promise of balanced audio to the useful companion app, Skybuds look like the portable wireless earphones we've been waiting for.



SLEEPPHONES EFFORTLESS

ABOUT \$180 | WWW.SLEEPPHONES.COM

If you struggle to get to sleep at night, the solution could be something like the SleepPhones Effortless, especially if you have to put up with a snoring partner. It's the wireless version of the eponymously named SleepPhones, a soft headband with slim-line, wireless headphones embedded inside, designed to help you drift off to relaxing music. Now, we all probably know someone whose snoring keeps others awake at night, so this could help suffering partners drown out the noise, but they're also potentially good for anyone who's wanted to nod off to soothing music without the discomfort of traditional earphones. These new ones will be available from April 2016.



Divide by zero

Les Pounder interviews Eben Upton about the Raspberry Pi Zero's journey and some good advice that helped pave the way for a US\$5 computer.

With the surprise release of the new Raspberry Pi Zero, we sat down with Eben Upton, the head of Raspberry Pi Trading, to talk about its genesis and the journey that it has taken along the way.

WHY DOES THE PI ZERO EXIST AND HOW DID IT COME TO MARKET?

There's an element of "because we can", and if you can build it, why wouldn't you? The reason we made Pi Zero is because the Raspberry Pi is still too expensive, not for a lot of people, but there is a subset of people who are wondering if coding is for them and this is their "first toe in the water".

The idea was to provide something of a stepping stone to general computing at a low cost. If people like it, then they will move on to Raspberry Pi 2 and use their Pi Zero for another project. When we first thought about making a low-cost device, we first thought: shall we make a Pi or something with the Pi name but using a microcontroller? We very quickly backed away from that idea because we felt that it had to be a bona-fide Raspberry Pi that runs Raspbian and has the GPIO which also enables users to be part of the community – and the community is the big thing about the Raspberry Pi. I now find that if I Google generic Linux questions, I get answers related to the Pi, which is nice. We do see the

Raspberry Pi as bringing Linux to a whole new generation and different type of person who wouldn't have imagined using Linux.

INITIALLY, YOUR IDEA FOR THE PI ZERO WAS TO CREATE A MORE POWERFUL PI?

Yeah, we started thinking about what was to become Pi 2 in 2013, and this was to be a more powerful board, but after a chat with Google's Eric Schmidt, where he said that was "a stupid idea and that you should try and make things which are less powerful and cheaper", which was great advice. So we scrapped work on what would have been a Pi 2 in late 2013/early 2014. We chose to take a longer route to produce Pi 2 for the same price as the original Pi. This enabled us to work on another strand, which generated the \$35 Raspberry Pi A+ and finally the Pi Zero at US\$5.

WHO IS PI ZERO AIMED AT?

Our primary target are those that want a low-cost introduction to computing. But who else will buy it? Well, enthusiasts such as myself who will buy it for IoT, robotics and embeddable home projects where you need something small and power efficient.

THERE SEEMS TO BE A BIT OF INTEREST FOR A CHEAP COMPUTER, WITH 'CHIP' (A US\$9 CROWD-FUNDED COMPUTER)

WHICH IS STILL SOME WAY OFF, WHEREAS PI ZERO IS HERE NOW.

The Pi Zero isn't a mean-spirited attempt to knock over other people's business models; this is the best Pi that we could make at the lowest price. One of the things we are proudest of is that, before Pi, there just weren't machines like this for less than US\$100. Now we have this enormous world of cheap Linux computers and we are never upset when another one is introduced by another business.

PI ZERO SPORTS A 40-PIN GPIO. SO DOES THAT MEAN IT'S COMPATIBLE WITH EXISTING ADD-ONS?

100%, if it fits on a previous model, then it will work with Zero. We haven't released a formal specification for future Zero add-on boards but third-party suppliers are already releasing boards with a pretty close specification.

NOW THAT WE HAVE A \$5 COMPUTER, DO YOU THINK THAT USERS WILL THINK ABOUT PURCHASING AN ADD-ON WITH A GREATER PRICE?

Suppliers are already doing great things with smaller add-on boards, and because you can fit less stuff, they work out cheaper, but I suspect that add-ons priced around \$20-\$30 will have a great market, as people will want to buy accessories for these devices. ■

technotes

HOW IT'S DONE

That's a lot of elements by anyone's standards.

Sony a7R II

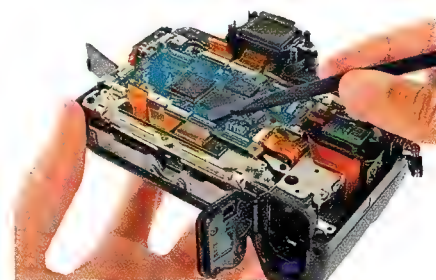
Back for seconds.

BACKGROUND:

The a7R II is Sony's second shot at a professional-grade mirrorless interchangeable-lens camera, but this time, Sony claims it can keep up with any Canon DSLR. While trial by fire may be the best way to judge a camera, trial by teardown is our specialty. With a \$3,199 price tag and no reflex system, we hope this mostly solid-state camera comes with an equally hefty reparability score.

MAJOR TECH SPECS:

- 42.4 MP Exmor R CMOS back-illuminated sensor
- BIONZ X image processor
- 5-axis in-body optical image stabilisation



If what you need is ribbons, Sony has you covered.

- 4K video recording
- Fast hybrid AF system with 399 focus points
- NFC and Wi-Fi connectivity

KEY FINDINGS:

- The rear of the camera is adorned with an articulating 3-inch LCD. This is a TFT LCD display with 1,228,800 dots. Dots? Since nobody lists a measurement other than 3 inches for this display, we busted out the calipers and calculator. At 2.5 x 1.75 inches, and converting from dots to pixels, we came up with around 270 ppi.
- We turn our attention to the JIS screws securing the bottom plate, mouths watering in anticipation of the tech beneath. And find the tripod mount plate. It may not be glamorous, but the mount slides out with ease, great news for reparability.
- Peeling the LCD from the articulating bracket reveals a PCB packed with passives. This little circuit board is probably a breakout board for the LCD, allowing for a thinner cable.
- Once we extricate the LCD and its delicate flex cable, the parts start flying. First up are the eyepiece and

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- viewfinder frame. The eyepiece slides off for easy swaps; the viewfinder frame is held in place with a few screws. As a mirrorless camera, the a7R II doesn't have an optical viewfinder. Instead, the viewfinder uses an XGA (1024 x 768 pixels) OLED screen to provide the user with accurate previews of images.
- Back to the viewfinder — turns out we can pull it straight out of its cavity. With its frame previously dispatched, it was only held in place by a gummy thermal pad. Why the thermal pad? Might have something to do with the 1.3cm XGA OLED. With 1024 x 768 pixels in half an inch, that's 2,560 ppi. Wowza.
- A7R II Repairability Score: 4 out of 10 (10 is easiest to repair). The tripod mount and viewfinder can be replaced without disassembling the camera body. While very difficult, the rear LCD panel can also be removed without disassembling the camera body. Accessing anything inside the camera requires removing the complex rear LCD panel first. Internal components are very intricately organised; repair without a service manual would be very difficult. ■

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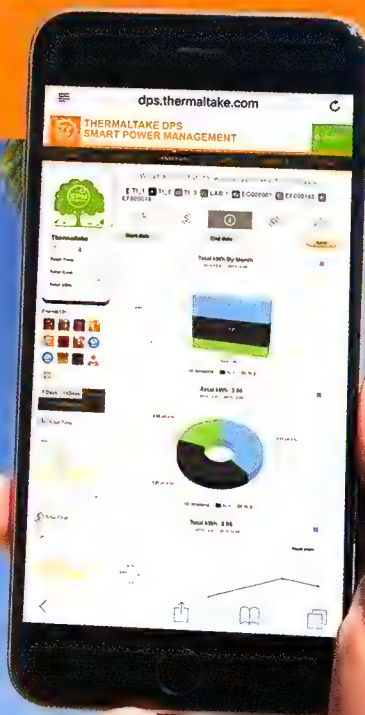


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EPINIONS

30% complete

Even in NBN-saturated Tasmania, getting access can still be a problem.

NBN ON AND OFF AGAIN

I have achieved time travel! By that I mean I have travelled from a 21st century 24Mbps NBN Internet connection to a dark ages 256Kbps ADSL 1 connection.

This is how it happened. I sold my house in Ross, Tasmania, where I had a 'you beaut' 24Mbps NBN connection. When negotiating over the purchase of a house in Wagin, Western Australia, the real estate agent assured me that an ADSL2 connection would be available. I was prepared to accept a moderate step down in quality and speed in order to be closer to my family who live in Perth.

This is where the 'time travel' kicked in. After arriving in Wagin, I was told that "no ports are available". This put the kybosh on ADSL 2. Telstra would investigate the possibility of ADSL 1.

In an attempt to influence Telstra, I closed my Internet and mobile phone accounts with iiNet and moved them to Telstra. That was a waste of time and effort, as ports did not magically appear as I had hoped.

Incidentally, the charge for an ADSL 1 connection is the same as for an ADSL 2. As a final coup de grace, I was kept on

"I guess I had better investigate the use of smoke signals or carrier pigeons."

hold for over 15 minutes while a technician investigated the possibility of an ADSL 1 connection.

I was so fed up with the whole process that I hung up on the man from Telstra. I wonder if he will call me back. Somehow, I doubt it.

I guess I had better investigate the use of smoke signals or carrier pigeons. Hang on a minute, with all the bush fires in our rural areas, smoke signals are not an option. Plus, the animal rights activists would be up in arms if I used carrier pigeons.

That only leaves snail mail and Australia Post is busy downgrading their services. Oh, I give up!!!

Terence Jacobson

MEDIA CENTER WOES

Agree totally with Gordon Drennan (APC December 2015), about Microsoft ditching Windows Media Center, in that Microsoft should have still made it available as an add-on feature for those of us who want it.

I still use it daily as the alternatives out there like Kodi, Media Portal and so on work, but are nowhere near as easy to set up and use as WMC is.

So while I like Windows 10 on my main PC, the media server PC and the one connected to the TV will still be running Windows 7 for a long time yet.

Ryan Hothersall ■

APCMAG@FUTURENET.COM

Come on, have your say!

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Take Action



Slacktivism isn't so slack after all

Online protest has a bad reputation, but it can effect change.
Shaun Prescott reports.

It's tempting to be cynical about the distant relatives in your Facebook newsfeed constantly sharing online petitions. Who cares about the installation of a new roundabout on the outskirts of Wagga Wagga? The bigger question is: does getting angry on the Internet even work? Isn't signing a petition on the Internet like whizzing into the wind, or worse, isn't it a way to feel like you've contributed to a cause without actually doing anything?

In many cases, yes, but according to a new study conducted by research journal PLOS ONE, online activism — or slacktivism, as it's sometimes pejoratively known as — actually works. Using the Arab Spring and Occupy Movements as case studies, the study found that the ability to easily “signal boost” messages via platforms like Twitter helps word spread faster, massaging discontent and subverting the usual reliance on traditional (and often unreliable) media coverage.

While people on the front line of protests are indispensable, it turns out

that the more passive participants retweeting or sharing content generated on the ground are critical, too. The PLOS ONE study claims that those people “playing along at home” on their computer screens or smartphones are contributing to these causes “at levels that are comparable to core participants”. In other words, the people pressing against the barricades at the protests are heavily reliant on social media participants actively re-sharing the photos and sentiments expressed at ground zero. And more recently, activist groups like Black Lives Matter gained serious momentum in the wake of the 2014 Ferguson shooting, with Twitter wielded as a tool to demonstrate the ambivalence of traditional media towards police violence against African Americans.

While the Arab Spring and Occupy are a far cry from the controversial (and fictional, we might add) Wagga Wagga roundabout, the take away is the same: efforts to effect change online are not futile, nor are they

necessarily slack. Indeed, online petitions — usually for consumer-oriented concerns — sometimes actually work. For example, a Change.org petition demanding the Bank of America remove newly installed \$5 monthly debit fees was successful after 300,000 people signed it.

Governments also know that social media is a powerful activism tool. China has blanket-banned Facebook, and controversial Republican presidential candidate Donald Trump recently declared he'd like to “shut down” parts of the Internet, due to Islamic State's reliance on social media to propagate its agenda. That's hubris, of course, but in an increasingly fraught political climate, the ability to rapidly spread the word without relying on traditional media is an effective way for activist groups to apply unprecedented pressure.

So if you really do have a strong feeling about that roundabout — maybe sign your name? ■

ENDUSER

Share your stories!

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PROFESSIONAL TABLET

FROM \$1,249 | WWW.APPLE.COM/AU

Apple iPad Pro

Bigger, bolder, better for business?

It's hard to overstate how big the iPad Pro is. While its screen size of 12.9 inches might not sound like a huge increase over the 9.7-inches of the iPad Air 2, in the flesh, the Pro proves monstrous, with a footprint that's only a little smaller than a 13-inch MacBook Air. While it's not overly heavy and is quite thin, its large size means that this is a tablet that needs to be held firmly with two hands, plonked on a desk or, at the very least, nestled in the crook of an arm.

That 'Pro' in the name should make it clear where Apple's pitching this one: at the creatives and business users who've slowly been warming up to tablets over the last few years.

While Apple CEO Tim Cook may have repeatedly poo-pooed the very concept of 2-in-1 tablet/laptop hybrids, the Cupertino company's new iPad Pro sails pretty close to the Surface Pro design, what with its optional keyboard

cover and stylus. The Pro certainly has the specs to live up to that promise on the hardware side of things.

That 12.9-inch display has a higher 2,732 x 2,048-pixel resolution and is powered by a new dual-core Apple A9X processor – a higher-end version of what's in the iPhone 6S – paired with 4GB of memory (twice any other iOS device) and a 10,000mAh battery that delivers Apple's promised 10-hour battery life. This is a blazing-fast tablet – the quickest ARM-based device we've ever seen – that's about 50% faster than the iPad Air 2 across the board. As with all the other iPads, there's optional 4G data support too – something you don't get with Microsoft's competing Surface line in Australia.

SINGING IN THE KEY OF BUSINESS

On its own, the iPad Pro arguably isn't much more than a bloody big iPad. It's largely through accessories that it's 'pro' pitch starts to solidify.

The Pencil is the first part of that equation, a comfortably sized and weighted Bluetooth stylus that offers about 12 hours of use per 20-minute recharge – something that requires you to slightly clunkily plug it into the iPad Pro's Lightning port.

Apple calling this stylus the Pencil isn't just about giving it a hipster name either. Like a real pencil, the angle at which you use it controls the stroke width, so in supported apps, it makes for an excellent sketching and painting tool that's quite intuitive and organic in use.

The other half of that productivity formula is the Smart Keyboard, effectively one of Apple's smart covers with a keyboard attached to the end. This can initially be a tad clunky to unfurl and attach, but once you get used to how it works, it's fairly smooth (though never quite seamless). The keyboard has a sealed design that should make it more resistant to spills, and keys have a

slightly rough texture, like synthetic fabric. Like many other iOS hardware keyboards, this one packs the traditional Mac system keys (Control, Option and Command) which means you can use many OS X keyboard shortcuts, including cutting and pasting, Command-Tabbing to switch between apps, or using the arrow keys for quicker navigation in text.

There's some funky tech inside the keyboard too – it doesn't use Bluetooth, instead connecting physically to the iPad Pro and drawing power from the latter.

On the go, it works better on the lap than the Surface Pro, too, thanks to a flatter base design that keeps it more stable. It's not as good as a real laptop, mind you, but you can get by.

There's not much to complain about with the Smart Keyboard, although we do feel that its closeness to the screen isn't ideal. Every now and again during vigorous typing sessions, we

"It requires compromise and adjustment to use the iPad Pro in place of a laptop."



found one of our ring fingers would accidentally tap the screen, moving the cursor off to some random point and needing to be repositioned again. It's also a little heavy, adding 337g to the iPad's 713g and taking the whole package to just over a kilo.

WORKING WITH iOS & MOBILE APPS

The extra physical screen size has allowed Apple to put in an almost full-sized software keyboard, complete with a row of number keys and predictive text line. In updated apps, you also get to see more on screen, which means more characters per line and more rows of text when you're editing documents, more cells in spreadsheets and more room for tools and brushes in image-editing apps.

Having that kind of expanded view does undeniably make the Pro a better device for getting stuff done, and it makes iOS 9's split-screen multitasking

mode a lot more usable. Many of iOS's best productivity apps have been updated to take advantage of the Pro's new dimensions and some design-oriented ones have even added Pencil-specific support.

iOS isn't as productivity-friendly as a desktop OS, and it requires compromise and adjustment to use the iPad Pro in place of a laptop.

Beyond work applications, there's a lot to like about the Pro. Gaming — and, in particular, playing intense 3D titles like racing games — is a spectacular experience, and better speakers (of which there are four) make it great as a portable movie player, too.

FIRST-BORN PROBLEMS

Despite everything the iPad Pro does right, there are still elements that have been overlooked or just don't live up to Apple's much-vaunted design ethos.

A key one of those is the lack of built-in handwriting support. OS X has had some form of handwriting

transcription for over a decade, so it's perplexing to see it missing here. Yes, you can cludge it in via third-party keyboards and cloud-connected apps that will upload your scribbles and translate them to typed text (such as Microsoft's OneNote), but not having handwriting as a universally accessible feature is a serious shortcoming. It's something the Surface line has done well since version one, and limits the Pro's capabilities when it comes to work flexibility.

There's also nowhere to dock the Pencil when it's not in use and the Smart Keyboard only lets the iPad sit at one angle, which may not suit taller users. And iOS feels a bit Fisher Price in some areas: despite all the extra real-estate, you still only get 20 icons per home screen (with a lot of empty space).

Then there's the price. While the base iPad Pro itself is reasonably affordable — the 32GB Wi-Fi

model costs \$1,249 and the top-end 128GB/4G option is \$1,699 — to get the full 2-in-1 solution, you'll need to pay \$165 for the Pencil and another \$269 for the Smart Keyboard.

THE BEST OPTION FOR PRODUCTIVITY?

This is a device that's most successful within one specific niche — graphic designers who use pen-driven apps. Some of the other elements feel like very un-Apple-like compromises. For now, if you want a tablet for general productivity, the Surface Pro 4 is the more flexible choice. ■ Dan Gardiner

Verdict

Features
Performance
Value



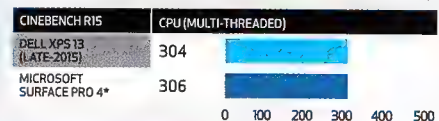
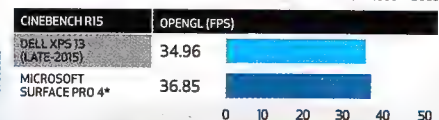
A gigantic, powerful iPad with some unique 2-in-1 capabilities... if you're willing to fork out for the accessories.



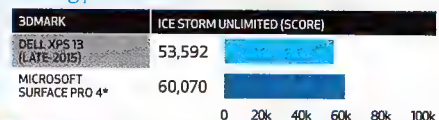


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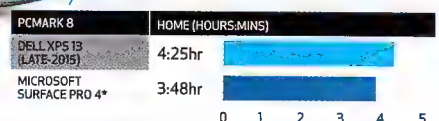
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Dell XPS 13 (Late-2015)

The Windows MacBook Air killer gets a little faster... and more expensive.

From the outside, Dell's refreshed XPS 13 looks identical to the well-received original version, which was released back at the beginning of 2015. It's a handsome design, with metal top lid and base and carbon-fibre everywhere else, and we saw the appeal, giving it a Hot Product award back when we reviewed it in APC issue 414.

The XPS 13 often gleans comparisons to the MacBook Air, but it's actually even more compact than the latter both in width and height. That's thanks to thinner bezels around the screen and the different screen aspect-ratio – it's 16:9 here, compared to 16:10 on the MacBook, meaning that the Dell is around a centimetre wider horizontally but also 2cm shorter vertically. The charger is nice and small, with a clean design that lets you wrap most of the

cable around the charger's body for safer stowage.

Now upgraded with new Intel 6th-gen Core i parts (a Core i7-6500U in the unit we tested), alongside the option of a higher-res 3,200 x 1,800-pixel touchscreen. We tested the top-end, gold-coloured model, which some may find classy but which we honestly thought looked like a nicotine-stained silver model...

Ahem. But we digress. Also nifty is a new Thunderbolt 3 port, which uses the same symmetrical connector as USB Type-C and supports DisplayPort, USB 3.1 and Thunderbolt connections and can even be used to recharge the laptop from an external source, like a power bank.

On that note, there's also a slightly larger battery inside than last year, going from 52Whr to 56Whr. One slightly unwelcome change since last year is a bump in price – the entry-level model is now \$1,799, up from the

original's \$1,499.

Otherwise, though, this is pretty much the same laptop. With 256GB of storage and 8GB of memory, it's a great little unit for getting stuff done basically anywhere. That said, we'd opt for the 1080p display over this 3,200 x 1,800 model, which suffers from software problems due to the high pixel density. While Microsoft and Dell's own apps work fine, when it comes to third-party programs Windows doesn't always scale interface elements and other onscreen components very well. Some programs, like Evernote, just look a little blurry – ironically meaning they appear less crisp and sharp than on a 1080p display. Other programs can be made unusable by rendering errors: text being too big or obscured, or buttons being positioned in unclickable spots – something we've found

particularly common when running installers.

And while battery life on this 3,200 x 1,800 pixel model wasn't bad at 4:25hr, that's over an hour shorter than we saw on the 1080p Core i5 model we tested last year.

So all in all, this is still a great little Windows laptop that's super-tough, compact and with a great mouse and trackpad.

But ignore the high-res touch version and go for the \$1,999 1080p model instead: it's the best all-round option.

■ Dan Gardiner

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

A compact and tough unit with excellent build-quality. Great for getting stuff done.





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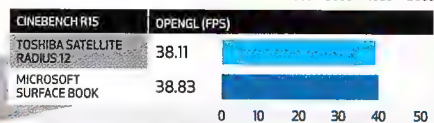
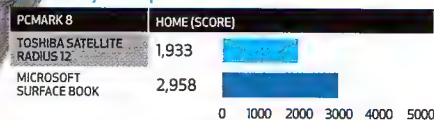
"The Radius 12 is the first 2-in-1 laptop/tablet hybrid to flaunt an Ultra HD, multi-touch display panel; a pretty impressive feat for a 1.3kg laptop."

LAPTOP/TABLET HYBRID

\$2,799 | WWW.MYTOSHIBA.COM.AU

LABS BENCHMARK RESULTS

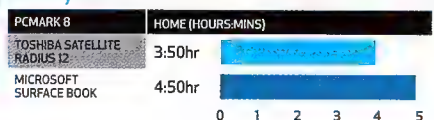
General system performance



Gaming performance



Battery life



Toshiba Satellite Radius 12

Can this impressively-specced little Satellite make it into orbit?

4 K TVs are coming to a pricepoint that make them broadly accessible, smartphone manufacturers like Sony have begun installing 4K screens in flagship smartphones and we've grown to expect Ultra HD (or beyond) displays on high-end desktop PCs and Macs. And Toshiba's just pushed 4K technology into another frontier – the hybrid laptop.

The Radius 12 is the first 2-in-1 laptop/tablet hybrid to flaunt an Ultra HD, multi-touch display panel; a pretty impressive feat for a 1.3kg laptop. While you can still see some pixels on a Full HD 1080p display (at least if you put your face against the screen), we weren't able to discern where any pixels were on the Radius 12's screen, no matter how closely we scrutinised it.

To back that up, this hybrid has one of the latest Intel Skylake (6th-gen) Core i7 processors, plus 8GB of DDR3 RAM and a 512GB SSD. On paper at least, that

makes the Satellite Radius 12 an amazing little unit that could potentially take on the Surface Pro 4.

Toshiba has gone to the effort of getting the screen Technicolour certified, meaning that colours are calibrated by hand against real colour swatches at the factory before it hits shelves. The integrated downward-firing Harman/Kardon Speakers aren't bad either, as long as you have the device in laptop mode on your desk or in tablet mode and fully folded-in on itself.

Where the Radius suffers a little is in its overall design and visual appeal. Uneven bezel thickness around the screen – it's different along the top, sides and bottom – throws the proportions off visually and makes it fractionally uncomfortable to actually look at the screen, particularly when holding it vertically in tablet mode. Though the keyboard actually feels fine in use, the keys have been squashed vertically to fit the smaller 12-inch form factor, making

the whole bottom half of the device seem a little cramped. For some odd reason, the device's brushed-metal exterior continues through to the touchpad, and because the grain runs horizontally, the touchpad ends up being overly grippy in particular directions.

There's also one downside to cramming a 4K display in such a small device; it chews through power. Toshiba reports that the Radius 12 can get up to nine hours using specific settings on the BapCo Mobilemark Benchmark, but from Futuremark's tougher PCMark 8 battery benchmarks, it didn't make four hours on work-related tasks. That's not actually too shabby given the Radius's slim dimensions, but it is a bit below the Dell XPS 13 and the Surface Book, which stretched to 4:25hr and 4:50hr in our tests.

In PCMark's Home performance benchmark, the Radius 12 performed below expectations, matching numbers usually

seen from cheaper laptops that sell for between \$1,000 and \$2,000. That said, there's definitely something odd going on here – likely thermal-based throttling. When you compare the Radius 12 against a Core i5 version of the Surface Pro 4 (an inferior processor to the Core i7 in the Radius) the Toshiba achieves less than two-thirds the general-usage Home benchmark score.

While it looks like it could take on the best, then, this hybrid comes up short in practice. You'll have to sacrifice general performance, a little battery longevity and some odd design decisions if you pick this one up.

Joel Burgess

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Odd design elements, an average battery life and performance hiccups make this one a bit of a mixed bag.

★★★★★



GAMING LAPTOP

\$1,299 | WWW.HP.COM/AU

HP Star Wars Special Edition Notebook

"Merchandising, where the real money from the movie is made!"

There's a fantastic scene in Mel Brooks' *Star Wars*-lampooning 1987 flick *Spaceballs*, where the Yoda-like character (Yogurt) breaks the fourth wall and espouses how important merchandising is in today's Hollywood movie-making machine. "Spaceballs the T-shirt, Spaceballs the Coloring Book, Spaceballs the Lunch Box, Spaceballs the Breakfast Cereal, Spaceballs the Flame Thrower!" he enthuses, picking up the latter and giving it a quick fiery blast.

It's no real surprise, then, that with the seventh *Star Wars* flick *The Force Awakens* now in cinemas, there's been an absolute flood of product tie-ins to go along with it. Thus we have this HP-made unit: *Star Wars* — the Laptop! Now, co-branding has a somewhat dubious history in tech — more recent examples

include a Pepsi phone that's now available in China, but in the past, we've also had *Transformers* shaving kits and a *Matrix Reloaded* phone from Samsung.

So what exactly makes a *Star Wars* laptop? In this case, it's a chassis that's lavishly adorned with Dark Side imagery — Vader on the lid, a storm trooper on the right of the keyboard deck and the Death Star on the left. The trackpad has the targeting grid from Luke's Death Star trench-run silkscreened onto it, and the keyboard's black keys glow red when their backlight is switched on. It's actually reasonably tasteful as far as conspicuous-branding goes, and when you fire the unit up, you'll find a host of *Star Wars* galleries to peruse (which almost completely ignores the prequel trilogy — something we can definitely appreciate), a comic book and a smattering of other digital books and

pamphlets. There's almost nothing to tie-in with the new seventh flick.

It's not a bad haul, but there's nothing particularly must-have — it would've been nice to get something a bit meatier: the digital copies of the movies perhaps, or a complete collection of *Star Wars* games. As it is, we can't see anyone but *Star Wars* superfans wanting one... but that may be the point.

Which is a shame, because performance-wise, this one's not all that bad. Now, it's not exactly "the fastest hunk of junk in the galaxy", but the 15.6-inch display, Core i5-6200U processor and 8GB of DDR3-1600 memory on offer are respectable, and joined by an Nvidia GeForce 940M, it's capable of a bit of gaming too — albeit at low detail settings. There's only a DVD drive, so you won't be watching the flicks on high-def Blu-ray, but that's

par for the course at this price. For us, the only real letdown is the 1TB 5400rpm hard drive; there's no sign of an SSD, which makes getting around in Windows 10 a little sluggish at times.

This is a half-respectable notebook in terms of value. The \$1,300 price is right for the specs on offer — the only machine close to this configuration is HP's own ProBook 450, which has a slightly slower AMD Radeon R7 340M graphics processor.

We guess that means this is an endorsement.

■ Dan Gardiner

LABS BENCHMARK RESULTS

General performance

PCMARK 8	HOME (TOTAL SCORE)
HP STAR WARS SPECIAL EDITION NOTEBOOK	2,396
MICROSOFT SURFACE PRO 4	2,873

Encoding performance

CINEBENCH R15	CPU (MULTI-THREADED)
HP STAR WARS SPECIAL EDITION NOTEBOOK	126
MICROSOFT SURFACE PRO 4	306

CINEBENCH R15	OPENGL (FPS)
HP STAR WARS SPECIAL EDITION NOTEBOOK	23.2
MICROSOFT SURFACE PRO 4	36.85

Battery life

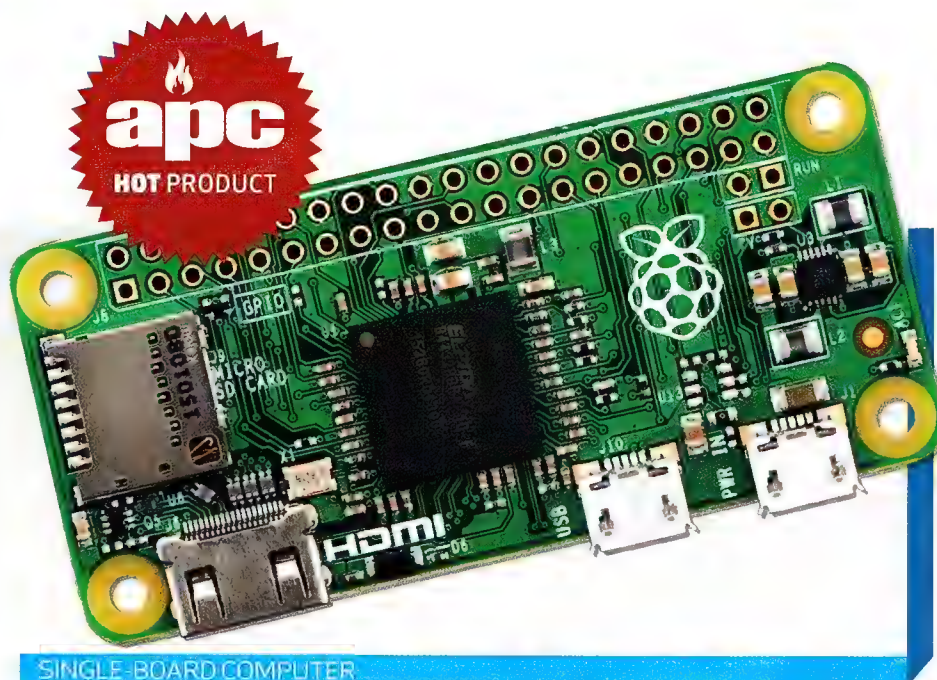
PCMARK 8	HOME (HR:MIN)
HP STAR WARS SPECIAL EDITION NOTEBOOK	4H 06M
MICROSOFT SURFACE PRO 4	3H 48M

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

It's not the fastest hunk-of-junk in the galaxy, but is actually quite good value for the specs on offer.





SINGLE-BOARD COMPUTER

US\$5 (AU PRICE TBA) | WWW.RASPBERRYPI.ORG

Raspberry Pi Zero

This time it has zero calories but does it still taste as sweet?

This is the second Raspberry Pi released in 2015 and, this time, the Foundation has shifted its focus from power to price. After a meeting with Google's Eric Schmidt, Eben Upton changed the focus of the next Raspberry Pi to being cheap rather than all-powerful.

The Raspberry Pi Zero is a US\$5 computer. We can now buy a computer for the same price as lunch. The Pi Zero is closer in specification to the original Raspberry Pi using the original BCM2835 System on a Chip (SoC) with an ARM11 CPU clocked at 1GHz, and it offers 40% more power than the Pi 1. Micro SD card storage is present on the Pi Zero, but the usual push-click locking mechanism has been removed. Ports around the board are sparse with only micro USB for power and peripherals and a mini HDMI port for audio/video.

The micro USB peripheral port requires the use of an adaptor as does the mini-

HDMI port, but as always, a number of retailers have already filled that gap. On Pi Zero, you'll find no DSI or CSI connectors. These were taken off to reduce the cost of the Zero. Pi Zero features the now standard 40-pin GPIO (General Purpose Input Output) but the header pins aren't present, offering an opportunity to try out your soldering skills. We tested the GPIO with Python 3 and Scratch and can report that it worked exactly as expected. We also tested a typical add-on board, in this case the Unicorn HAT from Pimoroni, and that too worked after installation. So the Pi Zero is compatible with a large number of add-on boards.

AN IOT THING

We tested the Pi Zero with the latest version of Raspbian Jessie, updated just before the Pi Zero was released, and boot times were slower clocking in at 52 seconds from power-on to desktop – comparable to the original Pi.

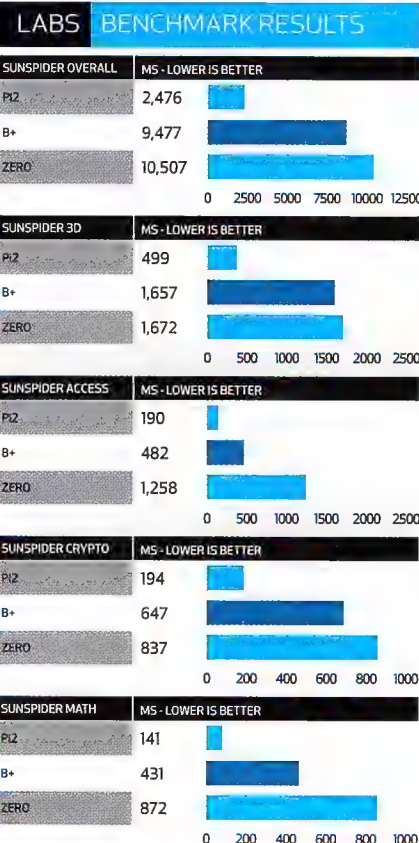
So what is the target market for Pi Zero? The makers are one group who will benefit from a low-cost platform with an expansive user base. The Pi Zero is an embeddable platform that will fit well into an IoT (Internet of Things) project or any other permanent installation. While the Pi Zero doesn't come with any Wi-Fi connectivity, it can be added relatively easily. In fact, there is already a hack to add a Wi-Fi dongle to the unused USB headers under the Zero. Another group to benefit from the Pi Zero are those who cannot afford a computer. With Pi Zero, we reduce the cost to the bare minimum and offer a low point of entry for families to enjoy learning together.

So why should you buy the Raspberry Pi Zero? If you love robotics, weather projects and hardware hacking then the Pi Zero is an ideal platform for low-cost experimentation. Embedding the Zero into a project is now just as cost-effective as using boards,

such as the ESP8266 and many of the Arduino clone boards. By removing some of the components and leaving a distilled Pi experience, we have a cheap, embeddable platform that can easily integrate into the Raspberry Pi add-on ecosystem. Being compatible with add-on boards and using the same OS also enables access to the vast library of Raspberry Pi centric resources.

The Raspberry Pi Zero now joins the family of boards and offers an exceptionally cost-effective first step into the world of computing, coding and electronics.

Les Pounder



Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

A platform that will excite and invigorate a generation of coders.

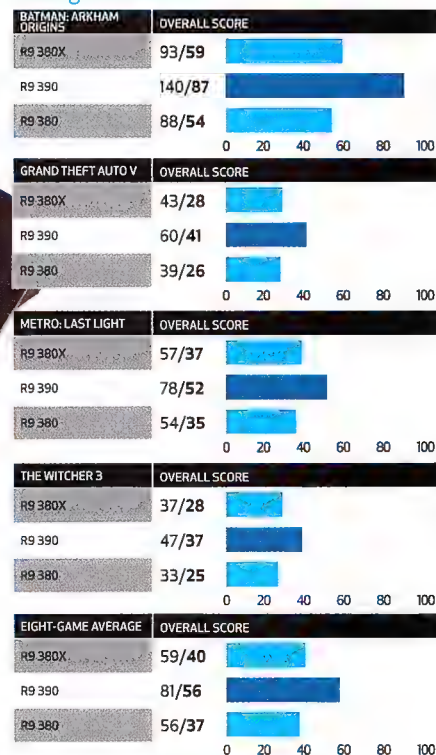




LABS BENCHMARK RESULTS

Results are average fps at 1080p/1440p. Our test bed is a 4.2GHz overclocked Core i7-5930K in a Gigabyte GA-X99-UD4 motherboard, with 4x 4GB DDR4-2666, 1TB Samsung 850 Pro, and EVGA SuperNOVA 1,300W G2, running 64-bit Windows 8.1.

Gaming Performance



GRAPHICS CARD

\$450 | WWW.AMD.COM

ASUS Strix-R9380X-OC4G-Gaming

Fitting neatly between the R9 380 and 390, AMD's latest isn't half bad.

Cast your mind back to the 10th of September 2014. AMD had just released its first GCN1.2 graphics chip, Tonga.

Launched as the R9 285, with 2GB GDDR5, but later with 4GB, Tonga contained new architectural enhancements, chief of which was the use of lossless delta colour compression. This allowed AMD to cut the memory bus down from 384-bit to 256-bit without impacting performance too much.

The net result was a less expensive graphics card compared to its predecessor (Tahiti), offering similar overall performance. The catch with the R9 285 Tonga launch was that it featured the same 1,792 graphics cores as R9 280 (aka HD 7950), with a couple of functional units disabled. The rumoured R9 285X never happened, but one year later, we're now getting

the fully enabled release of Tonga XT with the R9 380X and 2,048 graphics cores.

The key takeaway is that the R9 380X is practically the same as the R9 380, but with more cores. It has the same clock speeds for the GPU core and GDDR5 memory, so the only advantage is having 14% more cores. The common price for the standard card reflects these facts, with a price only 15% higher than the R9 380. AMD notes that add-in board partners may charge slightly more for custom coolers, which is the case for our review sample. The ASUS Strix R9 380X OC isn't stock clocked. With the custom cooler, the core is slightly overclocked. The GPU runs at 1,050MHz, as long as the overclocking button is pressed in GPU Tweak II. It may be nearly four years since the 7970 was released, but the "new" R9 380X barely outpaces that venerable GPU. On the

surface, that might not seem very impressive, but there's a reason AMD positions the 380X as an upgrade path for owners of the HD 7850. When the 7970 launched in 2011, it was a monster and carried a monstrous price tag. Now you can get nearly the same performance, using less power, for less than half the price.

TESTING TIMES

The R9 380X outperforms the R9 380 by almost 10%. Nvidia's chief competition comes in the form of the GTX 960, available in either 2GB or 4GB. We tested the 2GB model and there are certainly games where the limited VRAM is a factor. Considering the 2GB cards are priced closer to the 380, while the 4GB cards are priced roughly equal to the 380X MSRP, drawing a final conclusion is difficult. What we can say is that 380X wins the battle at 1080p Ultra and 1440p Ultra by nearly

20% against the 2GB card.

Looking at the big picture, the R9 380X is a good GPU that's able to handle 1080p gaming at maxed-out settings in most titles.

The R9 380X is where GPUs start to get potent. It's half the price of the 390X, at 66% of the performance. However, the R9 380 is only 5-10% slower.

Even so, if you are building a new PC and are in the market for a \$400-\$450 graphics card, the R9 380 and 380X have that market locked up for now.

■ Jarred Walton

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Great price-to-performance ratio; runs quiet; faster than the competition.



"It's a follow-up to last year's excellent RT-AC87U, which bumps the theoretical top wireless speed from 1733Mbps to 2167Mbps."



BROADBAND ROUTER

\$390 | WWW.ASUS.COM/AU

ASUS RT-AC88U

A router that begs the question, "How fast is fast enough?"

Long-term APC readers will know that we're generally fans of ASUS's routers. The Taiwanese company has aptly transferred its penchant for enthusiast-focused features over from its motherboards and graphics cards to its networking division. The result is feature-packed routers that often go far beyond what other dedicated networking companies churn out and this RT-AC88U is, generally, another great example.

Ostensibly, it's a follow-up to last year's excellent RT-AC87U, which bumps the theoretical top wireless speed from 1,733Mbps to 2,167Mbps. The caveat to that speed – and it's a big one – is that, if you want to get anywhere near it, you'll need to grab a second RT-AC88U to use as a wireless bridge. No smartphone, laptop or USB adapter we've seen even offers 1,733Mbps Wi-Fi built-in. To its credit, ASUS has made switching to and using bridge mode on the RT-AC88U dead easy, but at

\$390 a pop, you're looking at a nearly \$800 outlay.

Thankfully, more speed isn't the only thing ASUS has thrown into the mix. There's also four extra Gigabit Ethernet ports in the back, for eight total – a boon if you're lucky enough to have your router near your entertainment or computing hub – and a sprinkling of upgrades and additions to the router OS too. One of those is a lifetime subscription to a service called WFast – a VPN that's focused on routing gaming traffic to give the fastest ping times. In our testing, we seemed to have the best results when connecting to major servers, like Blizzard's Battle.net – though your mileage may vary and it may take some trial and error to figure out when it's worth using.

ASUS has also upgraded its Quality of Service tools – on the older model, you had to basically choose between smart or manual modes – with a new front-end that gives you a drag-and-drop prioritisation so you can

decide what kinds of traffic are most important needing a degree in networking.

Of course, that's on top of an already overflowing range of excellent features for parental filtering, bandwidth monitoring, basic NAS features (including cloud-based access and a built-in downloader for torrents and usenet), VPN server and client support (the latter letting you plug in your login details for a commercial VPN provider and protect your entire network) and much more. Most of those features are well-implemented and explained in the interface.

Now when it comes to actual wireless performance, the speeds we experienced were a little erratic. We used the RT-AC88U with ASUS's RT-5300 in bridge mode (its other new router that supports 2,167Mbps 802.11ac) and while we saw sustained reads and writes of up to 95MB/s – a good 30MB/s faster than we get from most 1,300Mbps routers – for much of the time, those transfer rates

hovered around 70–80MB/s for writes and 65MB/s for reads. This was with the devices in ideal test conditions – around 5m apart with line-of-sight and no obstacles in the way. On our typical test laptop (a 2013 MacBook Air), our speeds peaked at the usual 50–60MB/s – the same as last year's RT-AC87U.

And that's the crux of the situation really. At around \$100 cheaper – and still offering faster Wi-Fi than you'll likely be able to use – the RT-AC87U is arguably a slightly better buy than this new unit... unless you can actually use the extra Gigabit Ethernet ports and the more configurable QoS.

■ Dan Gardiner

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

An excellent, full-featured router that's slightly undermined by its more-affordable predecessor.





ADSL ROUTER

\$579 | WWW.DLINK.COM.AU

D-Link DSL-4320L

It's got the speeds, but it's a bit short on smarts.

If you like 'em loud and proud, D-Link has just the router for you. The DSL-4320L (AKA the Taipan) is the ADSL-equipped version of the D-Link's older DIR-890L router, a model which was launched early in 2015.

With six antennas apiece and glossy racecar paint jobs, both look essentially identical: this model just comes in bright-blue, rather than the DIR-890L's red. Both are massive devices that, at a glance, look more like souped-up quadcopter drones than the stationary pieces of networking gear they actually are.

For now, the Taipan is an ANZ exclusive, and it's what vendors have been calling 'tri-band' routers, meaning they have three wireless radios inside. That's a single 2.4GHz 802.11n-capable radio (supporting speeds up to 600Mbps) and two 802.11ac 5GHz ones (at up to 1300Mbps a pop), with one of the latter also offering MU-MIMO support. This is the first tri-band router

with an ADSL modem built in – thus, the high asking price.

The good news is: you don't need to know all that much about what's under the hood to benefit from all that tech. The Taipan can be set up to only offer one Wi-Fi network for you to connect to, and based on the abilities of the device you're using (smartphone, laptop, TV, games console or other), the router will connect you to the right radio. That MU-MIMO support means it more effectively distributes its wireless bandwidth when multiple devices are connected. Without it, you might find one device hogging all the speed.

At close range, the Taipan is fast. We clocked speeds of up to 70MB/s on our 867Mbps test laptop, which is basically maxing-out the latter's Wi-Fi. It didn't quite fare so well at longer ranges, around 20–25Mbps where the best can manage 30–40Mbps.

Still, hardware-wise, it ticks most of the boxes you

could reasonably expect. But while the onboard software features also cover all the basics most people will need (including USB storage support and mobile apps for configuration from your phone) and are reasonably easy to use, those features often aren't as flexible or deep as you'll find elsewhere – especially when compared to the likes of the Synology RT1900ac.

It's in the configuration options and details that the DSL-4320L falls a bit flat. There are parental controls, for example, but they're only rudimentary – just a website filter for 24 sites. Other brands offer cloud-based services with sophisticated blocklists based on different types of heuristic content filtering. And while the Taipan does have a scheduling feature, this only lets you turn the firewall and website filtering features on or off.

The statistics page is another example. It can give you a live view of traffic being used and the total

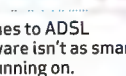
that's been downloaded since the router was rebooted, but there's no real configurability here, or the ability to drill down and, say, track individual clients or set quotas for them, or specify when your broadband monthly quota is reset so you can keep track of your total downloads.

That lack of feature-depth may not matter to some, but for us, when you're asking a premium price – and \$580 is definitely premium – you should be able to expect the best across the board. And with its current software setup, the DSL-4320L doesn't quite deliver.

■ Dan Gardiner

Verdict

Features
Performance
Value



Tri-band 802.11ac comes to ADSL routers, but the software isn't as smart as the hardware it's running on.





NAS BOX

\$4,300 | WWW.QNAP.COM

QNAP TVS-EC1080+ NAS

A NAS for the power-hungry.

The QNAP TVS-EC1080+ is an über-NAS. Pitched as an enterprise-level unit, the TVS-EC1080+ packs killer hardware features, as well as a host of applications that users should find handy.

QNAP spares no expense, tossing in a 3.4GHz quad-core Xeon processor, 32GB RAM, dual 128GB SSD caching and 10 full open bays. Make no mistake, this beast can do much more than store your family photos. Small to medium-sized offices would find the TVS-EC1080+ useful, especially with its large capacity and integrated 10GbE support. The primary function overall for this unit is to serve files or databases — fast.

Most of the software features won't be used in a business environment. Photo backup and serving, torrent downloading and media playback are some of the features available out of the box but we're more interested in performance.

The TVS-EC1080+ is no more difficult to set up and use than any other NAS in QNAP's lineup. We just installed the hard drives into their cages and plugged them in. You can configure the storage via the built-in HDMI interface or by logging in to its web interface — but there's only so much you can do with the two-line built-in display.

We configured our TVS-EC1080+ with equally impressive drives from HGST in the form of the Ultrastar He8 8TB helium drives. HGST offers the Ultrastar He8 in both SATA and SAS, but the TVS-EC1080+ only supports SATA. The Ultrastar He8 drives are fast and offer copious amounts of capacity, and are perfect for a NAS such as this.

We filled all 10 bays with HGST Ultrastar He8 drives for a total raw capacity of 80TB. RAID users be warned, though: at these monstrous capacities, chances for an array failure sky rocket, and RAID

rebuild times will be a nightmare.

PRO PERFORMANCE

Performance is stellar, of course, thanks to the Xeon CPU and 10GbE network support. But performance is only one of the TC1080+'s faces. Well-heeled home users will find lots to do with this NAS, while business users will be excited about its scalability and ease of use.

For business users, the TVS-TC1080+ is a powerful starting point. The NAS can be expanded with dedicated expansion units, but be warned: you'll lose the ability to use 10GbE because the 10GbE card needs to be swapped out for an SAS card. The onboard caching is also going to be great for database storage, where a large number of users would have the NAS hitting the cache SSDs often. In a home environment, the SSD will stay inactive almost all of the time.

If you're in a need of serious storage capacity and

performance for NAS apps in a single unit, the TVS-TC1080+ is your go-to unit. But no one should buy this behemoth simply for storage capacity. You'll get the most out of it if you need to run programs such as virtual machines, and support multiple simultaneous users. Simply put, the TVS-EC1080+ is overkill for home use. Xeon processors notwithstanding, it's very difficult for a home environment to take advantage of the hardware inside the TVS-EC1080+.

But if you must have an über-NAS, the TVS-EC1080+ is one such option.

■ Tuan Nguyen

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

10GbE; 10 drive bays; SSD caching; can be used as a PC; five-year warranty.





PORTABLE SSD

\$140 | WWW.SANDISK.COM

SanDisk Extreme 500 Portable SSD

Not the most portable, but delivers if you need fast external storage.

What's the difference between a USB flash drive and a portable SSD? Both Samsung and SanDisk seem to have decided that the distinction is a USB cable: portable SSDs need one, USB flash drives don't. That makes SSDs like this SanDisk Extreme 500 a significantly less portable option: while it'll still easily fit in a trouser pocket, you won't be putting this one (or Samsung's similar T1 drives) on a keyring anytime soon.

We bring up Samsung's product because SanDisk seems to be following pretty closely in the Korean company's footsteps with the Extreme 500; it's basically a slightly bigger and tougher-feeling (physically) version of Samsung's T1 portable SSDs that launched back in early 2015.

The idea behind these is to offer the fastest possible speeds, giving you external storage you can do intensive AV work from in real-time, or

just copy files really quickly. On the 120GB Extreme 500 we tested (it's also available at 240GB and 480GB), that means read and write speeds of 423.7 and 350.4MB/s, respectively.

(We tested Samsung's 512GB T1 for comparison, which had near-identical read speeds but was about 35MB/s faster at 387.7MB/s.)

As is fairly typical with USB drives, there's not much in the way of software — you get SanDisk's SecureAccess suite (Windows and Mac), which lets you create an encrypted and password-protected 'vault' file that you can save sensitive files in.

Samsung's T1s are a bit smaller, but start at 250GB and \$190, making this a good entry-level option at \$140.

■ Dan Gardiner

Verdict

Not as portable as a USB thumb drive, but a lot faster than most of the latter. Okay value for the price.



PAYAM
Data Recovery

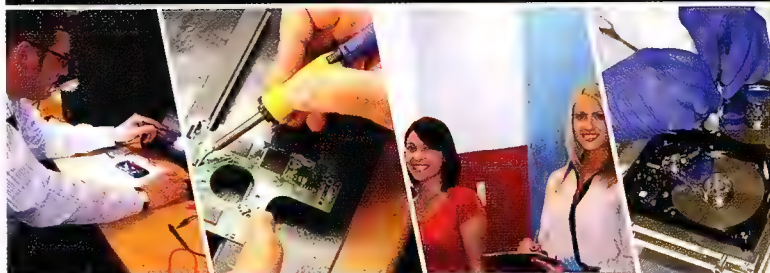
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GAMING MOUSE

\$110 | WWW.ROCCAT.ORG

Roccat Kova

Do we really need more buttons on our gaming mice? (Yes! The answer is always yes!)

If its most recent mice are anything to go by, German peripherals-maker Roccat seems set on rethinking gaming mouse conventions.

The Kova is, in theory, the slightly more wallet-friendly of the company's premium mice, with the right-handed Kone sitting above it. Like its 2011 predecessor (the Kova+) – and no, we're not sure on how you pronounce that either) this new model has a fairly straightforward, mid-sized body with a symmetrical design, meaning it's good for both lefties and righties of most grip types. The build-quality is good, made of a durable matte-finish plastic.

Where Roccat's gone a little outside the bounds of traditional design is in adding a pair of Smart Cast buttons, which poke up on the outside edges of the main left and right buttons. By default, they're not mapped to do anything, so it's up to you to decide what you want to use them for –

something that's quick and easy to do using Roccat's Swarm software.

Physically, the Smart Cast buttons are set at a roughly 45° angle, making them easy to press by just sort of rolling your finger at them. They do still take some getting used to, particularly just when it comes to remembering they exist. In first-person shooters, we ended up binding them to be the melee attack or (game config allowing) quickly toggling between weapons, and found them quite handy.

Our main concern with the Kova is the price. With competitors like Razer's DeathAdder Chroma going for \$65, this EB Games exclusive's \$110 price is a bit tough to swallow.

■ Dan Gardiner

Verdict

Provides some useful new buttons, but needs to be more competitive when it comes to price.



GAMING MOUSE

\$45 | GAMING.COOLERMASTER.COM

Cooler Master Xornet II

"No, not the Craw. The Craw!"

Obscure *Get Smart* reference to start this review? Check.

We've used bucketloads of mice that have promised they're perfect for all types of 'mouse kung-fu' disciplines – claw, palm or tips – but few have actually managed to deliver, due largely to length. The lazy gamer – AKA this reviewer – often starts a session with just the tips but inevitably their palm seeks refuge on the butt. The Xornet II changes this by essentially chopping around 30mm off its tail, bringing the dimensions to 76mm wide and only 105mm long. There's an ergonomic rest for the ring finger and textured rubber sides that make it comfortable to dig your meathooks into.

While the Xornet II happily works straight out of the box without installing Cooler Master's third-party software, it does mean you only get access to the three default DPI settings of 500, 1500 and 3500 (the max setting), which the

traditional DPI buttons under the scroll wheel just toggle between, instead of incrementally adjusting like more traditional setups. But at only 4.4MB (and without any registration or cloud saving that other vendors now insist on), the install won't pillage system resources or impact performance. Once up and running, you'll not only be able to tweak your DPI preferences but also customise lift distance, lighting colours and modes, plus remap the buttons for alternate use. There's nothing tricky to get your head around, but power users who prefer more control may find it a bit limiting.

There's no weight system or braided cabling, but for a mouse you can find for as little as \$45, we can forgive that.

■ Troy Coleman

Verdict

An incredible-value gaming mouse geared toward fingertip and claw-grip gamers.





SMARTPHONE

\$999 | WWW.MICROSOFT.COM

Microsoft Lumia 950

Is this the Windows 10 linchpin, or just another Windows Phone grenade?

The Lumia 950 is the first phone equipped with Microsoft's new Windows 10 Mobile OS, a premium flagship that's meant to show off the best of the company's new approach to mobile. However, there's a dramatic difference between what's acceptable in a budget all-rounder and what you expect from a top-dollar luxury smartphone.

There is a lot that pleases here – the 1440p, highly colour-accurate, 5.2-inch AMOLED screen looks impressive, the 20MP camera holds its own in the big leagues, with sharp Ultra HD 30fps video capture and colour-rich 5K photos, and the included USB-C charger juices up the 3,000mAh battery super-fast, charging over 50% in just 30 minutes.

It's thin, lightweight and feels great in the hand thanks to a softly textured back, with white or black colour schemes.

There's also a built-in iris scanner, Microsoft's alternative to fingerprint-

sensor security. It's an interesting idea and it works better than anticipated, but it does still feel like beta technology. Another perk to Windows 10 Mobile is Continuum – plug the Lumia 950 into a big screen, keyboard and mouse and run a streamlined desktop-like version of Windows 10.

The Lumia 950 uses the Snapdragon 808, a perfectly capable chip used in many upper-midrange phones, including the Nexus 5X. What's a bigger concern than being able to run demanding apps and games is finding any. The Windows Store is still a bit of a wasteland. The meagre selection of apps is currently further divided, with many not yet working on Windows 10 Mobile yet.

■ Joel Burgess

Verdict

Would be 4.5 star device, if only there were some more apps to use with it...



SMARTPHONE

\$569 | WWW.MOTOROLA.COM.AU

apc
RECOMMENDS

Motorola Moto X Play

Motorola takes a mostly-successful stab at a 'midrange' flagship.

This year, Motorola has taken the unusual step of releasing two different Moto Xs: the higher-end Style (which we reviewed last month and weren't enamoured with) and this mid-range Play.

The Play has a slightly smaller 5.5-inch screen but a much larger battery. The trade-off is that the Play is not as fast as the Style. It uses Qualcomm's mid-range Snapdragon 615 CPU in combination with 2GB of memory, 16GB of storage and an Adreno 405 graphics chip to deliver adequate but far from award-winning performance. Not that you'd really notice; with Motorola's mostly unmodified version of Android 5.1.1 as the OS, this is a slick and smooth experience.

While the Play isn't a particularly slim or striking device, it is a reasonably handsome one – its got Motorola's traditional curved back, which means it's comfortable in the hand,

and the 5.5-inch 1080p IPS display renders clean, sharp and colour-neutral images. It's robust too, with the same water and dust-resistance capacity as the Style, and the cameras are identical on these two Moto Xs: while not up to iPhone 6S or Galaxy S6 levels, it will satisfy all but the most fussy photographers.

The Play has a great battery life and supports fast-charging, but Motorola hasn't provided a charger with the phone: it's available as an optional extra for around \$40. And there's a microSD slot with support for cards up to 128GB, so if you want to cart around your media collection (or just take lots of photos) that's definitely an option.

■ Dan Gardiner

Verdict

Offers up a good mix of midrange features at a midrange price point. Does what it says on the tin.



software

» APPS FOR ALL THE PLATFORMS



Windows SOFTWARE

Photoshop Elements 14

The budget image-editing app returns with new tricks.

\$129.99 | WWW.ADOBE.COM

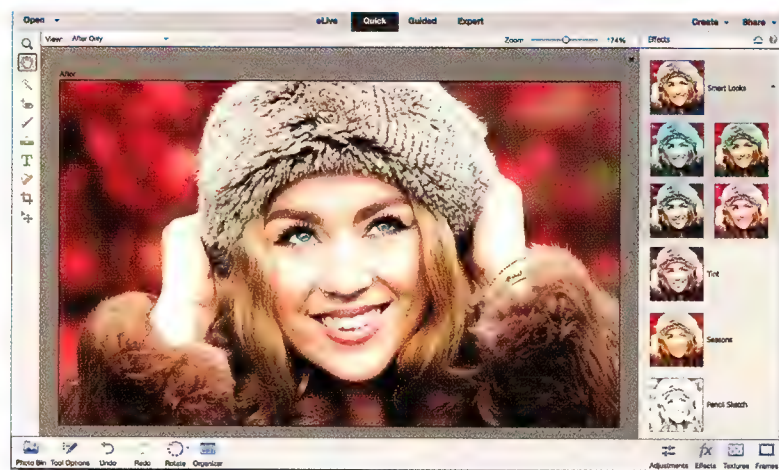


Adobe's cut-price photo editor doesn't offer the full feature set of its bigger brother, but there's plenty of depth to this beginner-friendly app.

Elements comes in two parts, the Organizer and the Editor. The Editor also includes a pared-down version of Adobe Camera Raw for processing raw images.

The Organizer is for sorting your image library, with intelligent modes that help to divide your photos into categories based on People, Places and Events. All three have been improved since the previous version, with facial recognition's success rate about a third better than in Elements 13. What's more, as you add new photos Elements will automatically add them to a person's stack.

Elements' photo editor is split into three editing modes – Quick, Guided and Expert – catering for different levels of expertise. Alongside them is eLive, which gives access to a curated selection of online tutorials. In Quick mode, settings and menus are kept to a minimum, with access to simple tonal adjustments and one-click effects. New in this version are Smart Looks, which pull out five effects from a database of over 2,500, based on analysis of your image. It's an interesting approach to the current craze for retro-looking filters, but the effects it offers can often seem rather random.



For those who want to take their skills further, Guided mode offers 40 step-by-step guides for common tasks. Interactive sliders show before and after images for each effect.

One of the clever things about the three editing modes is that you can switch between them. If you use a Guided edit to add an effect, then switch to Expert mode, you can peek under the hood to see how the effect takes shape. It's a useful device that will help beginners to get to grips with Photoshop fundamentals like layers and masks. When you're ready, Expert mode gives you full access to all the wonderful tools, filters, layer styles, blend modes and other features.

Adobe knows that everybody is a photographer now, so it has made a photo editor for everybody while still offering depth for the advanced user. Thanks to the three editing modes, the journey from beginner to seasoned Photoshopper is smoother than ever.

James Paterson

Premier Elements 14

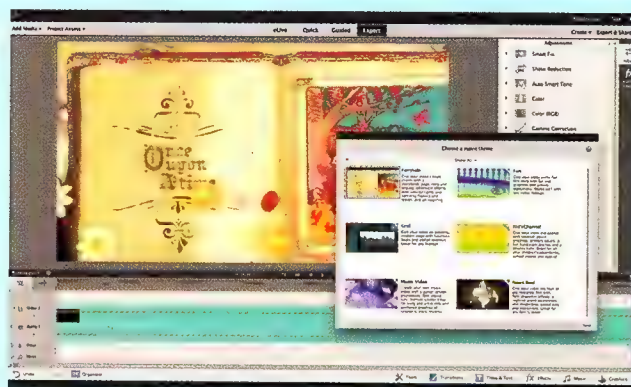
\$129.99 | WWW.ADOBE.COM



When Windows Movie Maker isn't enough and Premiere CC is too much, Premiere Elements is ideal. It's a video editor designed to make it easy to get started, with some useful higher-end features.

The big addition in this version is support for 4K video. It offers great quality at native resolution, too, however. Premiere Elements imports footage at its current resolution and makes that 100% scale as far as the project is concerned, with no apparent way of treating it as the larger footage that it is. Still, it's worth shooting in this format if you can, as simply shrinking 4K down (downsampling) usually looks better than 1080p video.

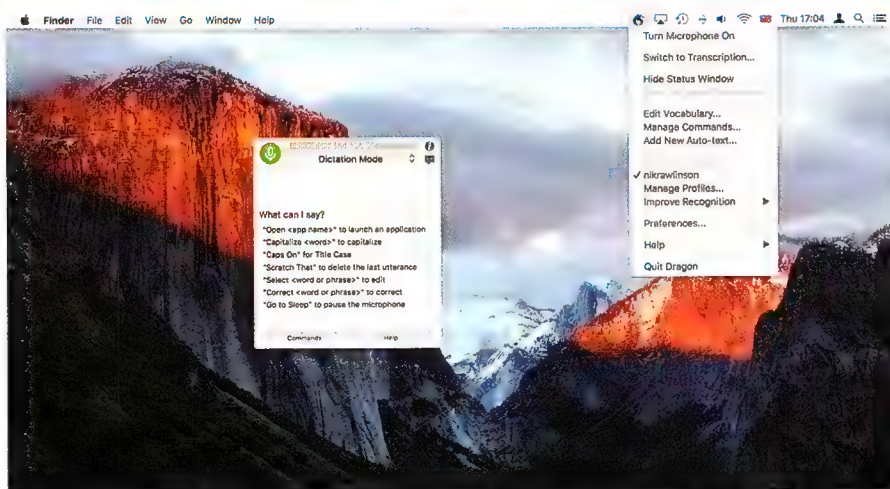
The rest of the toolset handles everything you'd expect it to, including organising video, tweaking sound, adding titles (and new Motion Titles with animation presets), and the usual set of effects and transitions that every filmmaker should sign a contract swearing never to use. More complex effects such as popping a single colour are handled via Guided Edits, which also help explain more complicated subjects such as masking parts



of an image and manipulating time. There's also Videomerge for basic chromakey effects, though you're unlikely to get a clean cutout, even with proper lighting and a green screen. For basic composition and home purposes, though, it's fine.

As ever, an excellent choice for video editing, but lacking the sense of innovation that it once offered. Richard Cobbett

Mac » APPS



Dragon for Mac

Is this revamped version still the Mac's best dictation tool?

\$200 | WWW.NUANCE.COM

Dictation is built into OS X and iOS, so why would you want to buy a third-party app as well? It's a good question, but if you spend at least a little time each day dictating, the convenience of having almost complete vocal control over your Mac — not just for dictation — makes Dragon well worth it.

It's not simply a transcription device: it can launch and close applications, move the mouse, and interact with OS X. It can also be set up to insert blocks of standard text with a single command, and the longer you work with it, the more accurate it will get.

Tradition dictates (no pun intended) that, when reviewing voice recognition software, you should use it to write the review, which is exactly what we've done here. We haven't written any of the body of this review using the keyboard, and whenever we wanted to make an amendment we've issued spoken commands to tell Dragon how to go back and make changes.

Upgrading from Dragon Dictate 4 is pain-free: it automatically reworks all the training you've given it to date, so

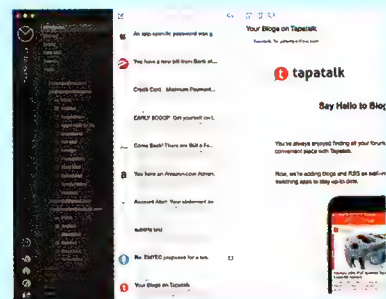
your manual additions to the dictionary stay. It also claims that it makes the dictation process more responsive, and our tests certainly bear that out, with very little delay between a word being spoken and appearing on the screen.

The interface has been rethought, too, with a new Dragon menu-bar item keeping the app close at hand. There's also a less garish dictation window, which keeps the most common functions in view and dynamically switches to correction mode when you verbally select a word or range of words in the document. Not that you'll need to do that very often: so far, we've only corrected a single word in this document.

As well as dictating live, you can use it to transcribe voice files, and an upcoming iOS and Android app will let you work on the move. This is scheduled to appear a little later in the year, and will sync with the Mac edition (with a paid subscription, sadly).

Dragon is flexible and very fast to work with, but there's no denying that, at \$200, it's expensive. Oh, and if you're wondering: the final tally of errors we corrected while writing this review? Two. Bottom line? Forget Apple's Magic Mouse and Magic Keyboard... Dragon is the Magic Mic, and it's brilliant.

Nik Rawlinson



Airmail for Mac

\$9.99 | AIRMAILAPP.COM



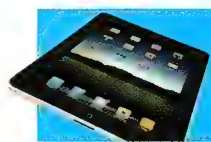
Airmail 2.5 is an email client that doesn't try to reinvent the wheel, but is built for OS X El

Capitan and loaded with niceties Apple has neglected. One of the coolest is a Today view widget for keeping tabs on the inbox, to-dos, or memos, although the application must be running in order to refresh such content. Another favourite is integration with FTP servers and cloud storage services such as Dropbox and Google Drive. Choose one, select an attachment, and files are uploaded and converted to clickable links in outgoing messages. Received attachments can be saved via OS X sharing extensions or used in Fantastical 2; entire emails (sans attachments) can be saved to Evernote.

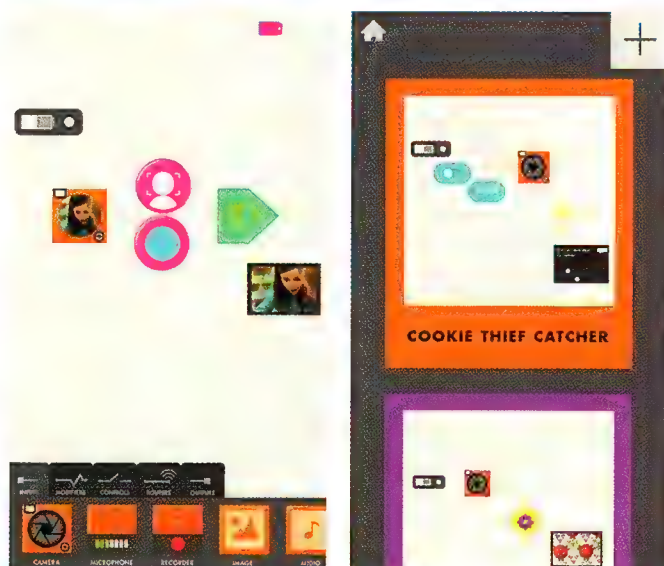
Airmail borrows liberally from Apple Mail's familiar triple-pane interface, but the left-side account sidebar is darker and wider, with one-click shortcuts for several different views — so comically small, they're easy to overlook. Thankfully, the list view displays sender and recipient names in larger, bold type with optional avatar.

The application provides granular control over nearly every aspect of the software. Airmail also allows messages to be moved or cloned between different accounts — features missing from most third-party clients. Unfortunately, there's no support for Google Apps, but the developer is working on an iPhone companion.

So, finally, here is a third-party email client to tempt us away from Apple Mail, but Google Apps users will want to look elsewhere for now. JR Bookwalter



App Store » iOS APPS



The Everything Machine

There's even a digital kitchen sink....

\$4.99 | WWW.TINYBOP.COM



Digital toy designers tend to cater for younger users; they probably presume older ones prefer "proper" games. Tinybop thinks that's left a gap, to be filled by The Everything Machine.

You might mistake this for an educational app about basic electronics. There are batteries, bulbs and beepers to connect, with logic gates between. Then you spot what else you can hook into your circuits. A camera, tilt and motion detectors, transmitters and receivers: this app lets you program your entire device.

It's a scribble pad for budding developers, with the potential to explode your creative world. This isn't about just turning bulbs on and off — you can catch cookie thieves using a light sensor, a camera and your photo store, or make a detector that tells colours apart.

However, the examples and short manual aren't enough to understand such a powerful toolkit. Apps for younger kids are simple enough to learn by exploring. This isn't.

It is worth the effort, though. It's not just the range of things you can build that's so enchanting — it's the satisfaction of building it yourself.

One of our best creations was a simple sound studio. With some switches and a bank of speed- and pitch-changer tools, we could remix our favorite songs to our heart's desire. We could have done the same with specialist software, but it's much more gratifying to work with tools of your own making.

Not only will you have fantastic fun with this app, you may help raise the next generation of programming wonderkids.

Matt Thrower

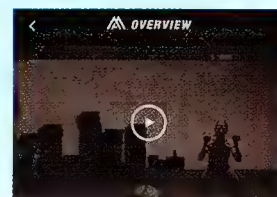
Mountain Athletics by the North Face

FREE | THENORTHFACE.COM



There are loads of training apps out there, but very few of them are targeted toward getting fit for specific mountain-based and high-altitude activities. It may sound niche, but don't discount it yet — this is the kind of training you generally need to pay a trainer to get.

Plus, who doesn't love the idea of taking off to the snow for the winter with the kids, taking that dream holiday and hiking to Everest Basecamp or even something as simple as running your first 5kms. You're going to need the legs and the steam to do it and this is where this great companion app comes in. The timed, circuit-based workouts are split into six individual sports; running, general fitness, alpine climbing, rock climbing, backcountry skiing and all-mountain skiing. Each program is six weeks long and asks you to commit four days a week to get the best results. You're also going to need access to a gym or at the very least some basic equipment at home as you squat, lunge, press, run and Scotty-Bob yourself to fitness and holiday fun. Troy Coleman



Leg Lactate Complex

EQUIPMENT NEEDED:
25lb Dumbbell or 12kg Kettlebell

OTHER OPTIONS:
Kettlebell

Three leg-focused, lactate-building exercises split up by hard, isometric tuck holds. This is interval or time-based training and you'll need a

START SESSION

Cloud Outliner 2 Pro

\$4.49 | WWW.XWAVESOFT.COM



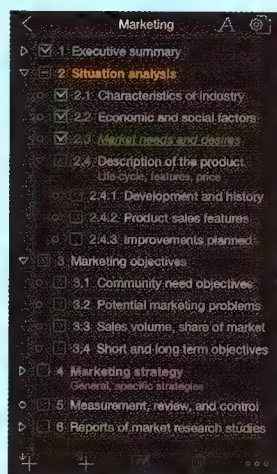
Capturing ideas in the form of outlines is one of those things you either do as a matter of course, or you don't. Cloud Outliner won't change that, but if you're in the former camp, it provides a way to put together outlines on the move very easily, and sync them with Evernote or a version of Cloud Outliner on another device.

It looks great, and its support for gestures, as well as its well-designed user interface, make drawing up outlines super easy. For example, to indent or un-indent an entry, you need only drag it right or left and it sticks. If you'd rather press a button, you can.

There are plenty of options for refining the look of outline documents, including a choice of light or dark themes, and there are also options to use colours for entries. If you're a regular outliner and don't yet have a go-to app, Cloud Outliner could be the one you've been looking for.

Creating and formatting outlines couldn't be any simpler.

Kenny Hemphill



AOC



U2879VF

4K 28-inch
ULTRA HD 3840x2160

**Rich in details.
Reach a new world.**



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Email: au@aocmonitor-anz.com

vision at **Heart**



Google Play » ANDROID

Fleksy + GIF keyboard

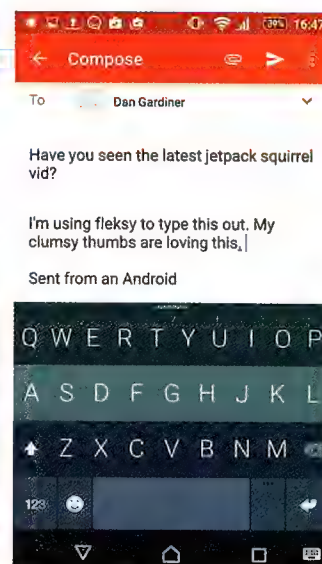
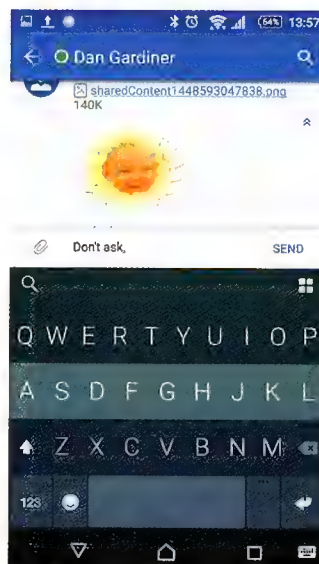
As easy as 'rssi'.

FREE WITH IAP | FLEKSY.COM



That cunning sell is a hint. Fleksy, you see, is a keyboard app that relies on swiping up, down, left and right to correct what you're typing out, and after a half a day of readjustment, it becomes second nature. All of it comes down to the controls, and that large, friendly, keyboard.

Swipe down after you've mangled what you're meant to write and you'll cycle through a list of alternatives. Swipe up and you'll go back through the words to undo your correction, and eventually add your new word to the dictionary. Flick left to delete the entire word, and right to add a space. While the keyboard takes up a fair amount of screen real estate, you can do a double swipe down to get rid of the space bar — useful when flicking right has become second nature. If words aren't enough, the keyboard's also loaded with emoji, imoji (vector art) and GIFs to insert into your texts and emails. The keyboard alone should speed up your text messaging, especially if you're loathe to use a trace to type style 'board (a function that Fleksy does not offer). Paul Taylor

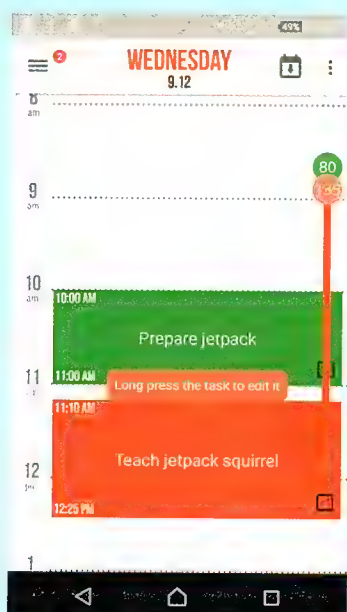


Accomplish

FREE WITH IAP | WWW.ACCOMPLISH-SOFTWARE.COM



Calendar reminders are all well and good, though there's nothing quite like a checklist. While many TechLife staffers use Google Now or Colornotes for short-term notes, Accomplish lets you write out tasks and then assign them to its calendar, or have them rest in a list for you to work your way through at your leisure. Accomplish will sync with your regular Google calendar, with the app's big, bold interface marking out when the task starts, and when to remind yourself that it's coming up. We found it useful for jobs that require a bit of time — like, say, an afternoon to write a story about apps, or putting several hours aside to practice a new skill — and having a visual, colour-coded list really focuses what to prioritise and when. Accomplish is limited in that there is no month overview, so if you want to plan ahead, you'll have to flick through every single day, one at a time. However, it's very fast and easy to set up. Paul Taylor

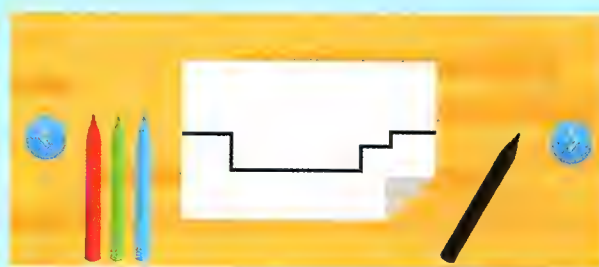


Draw Your Game

FREE WITH IAP | WWW.TINYURL.COM/TLA46-DRAW



Grab your pens and paper, because half of this platformer requires you to create it yourself. Black lines mark the hard, immovable parts of the world, while blue objects can be moved around as soon as your character touches them. Green shapes act as jump pads, while red objects will kill you as soon as you touch them, or can be used as a goal into which you feed the blue objects. If you've ever played Crayon Physics Deluxe, you'll have a good idea of what to expect here. Once your world is drawn on your physical bit of paper, you can take a photo of it, from which the app builds the level (or you can opt to play the 'adventure' mode with pre-set levels waiting). From there, pilot your character either to the exit, or destroy a set of blue objects. It's simple stuff — all you can do is move left, right and jump. It'll hardly trouble Mario for satisfying platforming, but with some imagination, you can create some pretty tricky (and very large) levels before publishing them for the world to enjoy. Paul Taylor



Draw your floors and walls in black

2/9

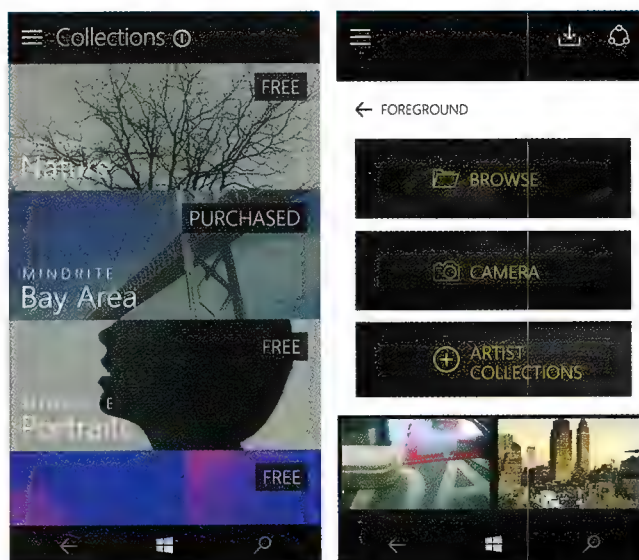
Windows Store » WIN PHONE 8

Fused

Throw your photos and vids into the blender.

FREE WITH IAP | WWW.EASYTIGERAPPS.COM/#FUSED

Though it might not be the most original photo-enhancement technique, photos with a profile silhouette – masking a background image of the New York City skyline, for example – tend to look pretty cool. The devs at EasyTigerApps seem to think so, too, and have developed a universal Windows 10 app that'll let you blend two images on the fly using your Windows Phone. The app has a suite of cropping and masking tools that will let you line up and blend the images in the way you want. The free version offers ample ways to throw two images together, though you'll have to fork out \$1.19 for image collections, editing tools and effect packages through the app if you want more in-depth manipulation. The interface can be a little tricky to learn at first, as there are no written labels or tutorials; the back button integration is also a bit clumsy and we often exited the app accidentally. The other thing we really love about Fused, though, is that you can even blend videos under 25MB with your favourite photos for an interesting effect. **Joel Burgess**

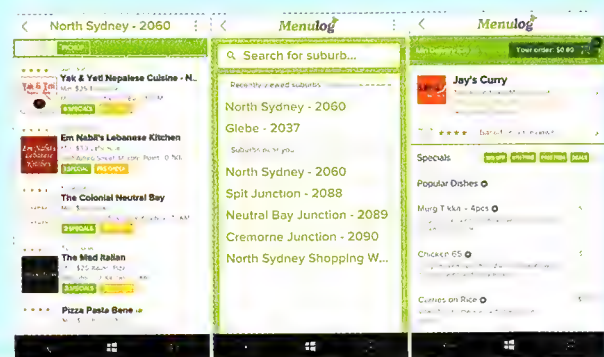


Menulog

FREE | WWW.MENULOG.COM.AU



If you prefer to order your takeaway online, then you're probably already well aware of Aussie takeaway service Menulog. Though this reasonably thorough food delivery-app has been available on Android and iOS for some years now, it has finally made it's way to Windows Phone. After punching in your postcode, Menulog will bring up a list of the various local restaurants in the area that deliver and, from here, you can click through to each one's menu and add dishes to your shopping cart. So with a few taps, this app can help you find a restaurant, order your meal and pay for it, all in less time than it'd generally take you to order over the phone. Menulog will notify you when the restaurant confirms your order and because you can store your credit card details, there's none of the usual payment hassles. With over 5,500 restaurants from across Australia, there are plenty of restaurants to choose from and the app even offers a range of unique discounts and meal specials. **Joel Burgess**

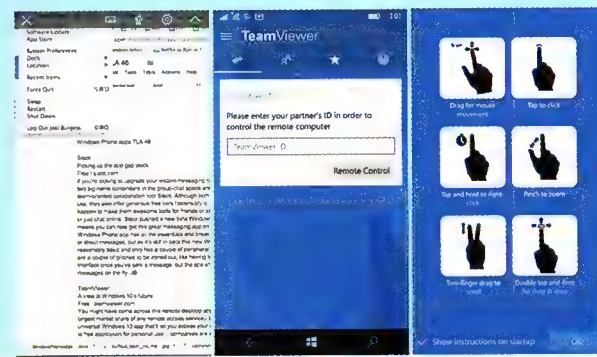


TeamViewer

FREE | WWW.TEAMVIEWER.COM



You might have come across this remote-desktop app already (TeamViewer boasts the largest market share of any remote access service), but the company has just released a universal Windows 10 app that'll let you access your PC from your smartphone. TeamViewer is a free application for personal use and once you download the app onto your PC and smartphone, there's no need for account setup. Remote login simply requires you to run the app on your PC and then copy the computer ID and randomly generated password from the screen to your smartphone. A couple of settings allow you to change the picture quality or whether the connection favours visual quality or a continuous frame rate, but other than that, the interface is streamlined. An initial prompt will give you a refresher on how the controls work for moving the cursor using your smartphone, and the 15% speed boost that the company boasts with the upgrade makes for an improved user experience. **Joel Burgess**





Sweet Home 3D

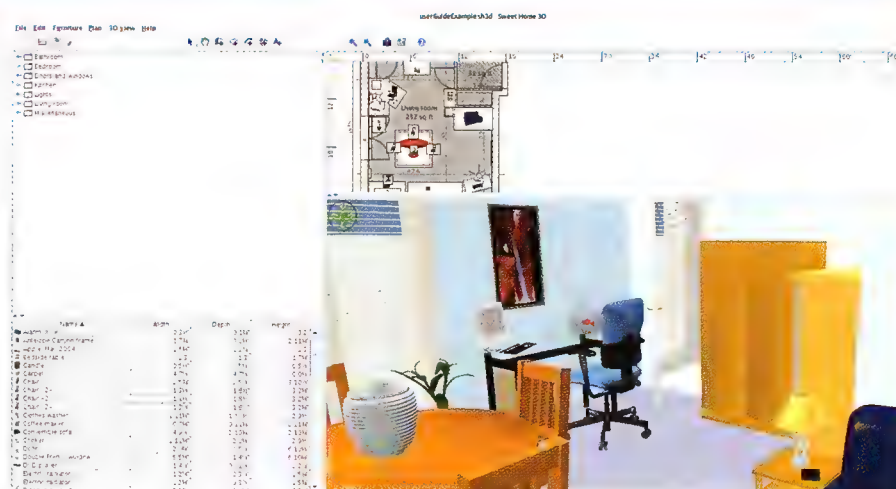
Home interior planner.

FREE | WWW.SWEETHOME3D.COM

For anyone planning furnishings for their house or apartment, before going out and buying anything, Sweet Home 3D is a great open source utility. Similar features exist such as IKEA's planning tool, but it's not open source and limited to IKEA-branded accessories only, as you'd expect.

Sweet Home 3D also has a much wider set of features, including an expandable furniture set and textures library, support for multiple levels on a plan and most appealingly editable parameters of each item, including size and proportions. You can also make your own items from scratch if you want or by importing from various supported 3D formats, such as OBJ, DAE, KMZ and 3DS.

The visual layout of SweetHome3D has a furniture categories tree on the left, where you can expand and drag the desired items onto the main part of the window where the 2D plan is drawn. The list of added items and



their dimensions is placed in the lower-left corner. You double-click an item to set its advanced options. The lower part of the window, just under the plan, hosts the 3D view which corresponds with the plan. You can drag the view to move around or even use the AWSO keys to move just as you would in a first-person shooter. Sweet Home 3D has an impressive set of tools for customising the plan: you can build walls, chambers, levels, play with backgrounds and textures and model the perfect living space of any style and size. The application is quite robust; it was written using Java (the GUI screams it) and looks identical on any platform. There's very good

documentation for Sweet Home 3D online, but perhaps the best entry point is downloading various sample plans from the official gallery. It's the easiest way to learn the basics of making your own interior.

Sweet Home 3D may appear in some Linux distributions through package managers, but it's also very easy to download the latest release from the project's website. Sweet Home 3D comes with its own copy of Java Runtime Environment for compatibility and stability reasons, so it should run just fine without the need for any extra dependencies.

Alexander Tolstoy

Drawpile

FREE | DRAWPILE.NET

Numerous graphic editors exist in the Linux-verse; some are racing to be the next Adobe Photoshop equivalent while others are aiming to be the Paint-like user-friendly applications. There are also a number of specialist editing tools, such as CinePaint, which focuses on retouching moving picture and Tux Paint, which is designed to be a simple-to-use graphics editor for kids. Drawpile is also very specialist: it's a drawing program focused on making collaborative work much easier to do.

At first glance, Drawpile's user interface may look like any common graphics editor, which isn't a bad thing if you're trying to work with others.

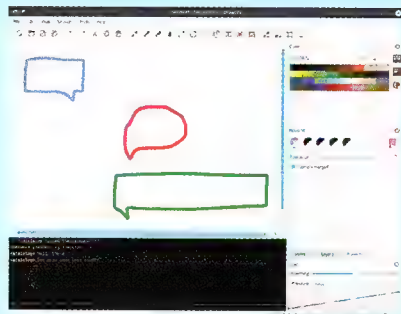
There's a drawing toolbar along the upper part of the window and a tool settings area on the right-hand side, which includes the usual elements,

such as colour palette, brush size, pressure tunables and layers etc.

The number of tools is quite modest but they are perfectly sufficient for producing simple schemes, sketches, balloons or even a draft of some business galloons or other.

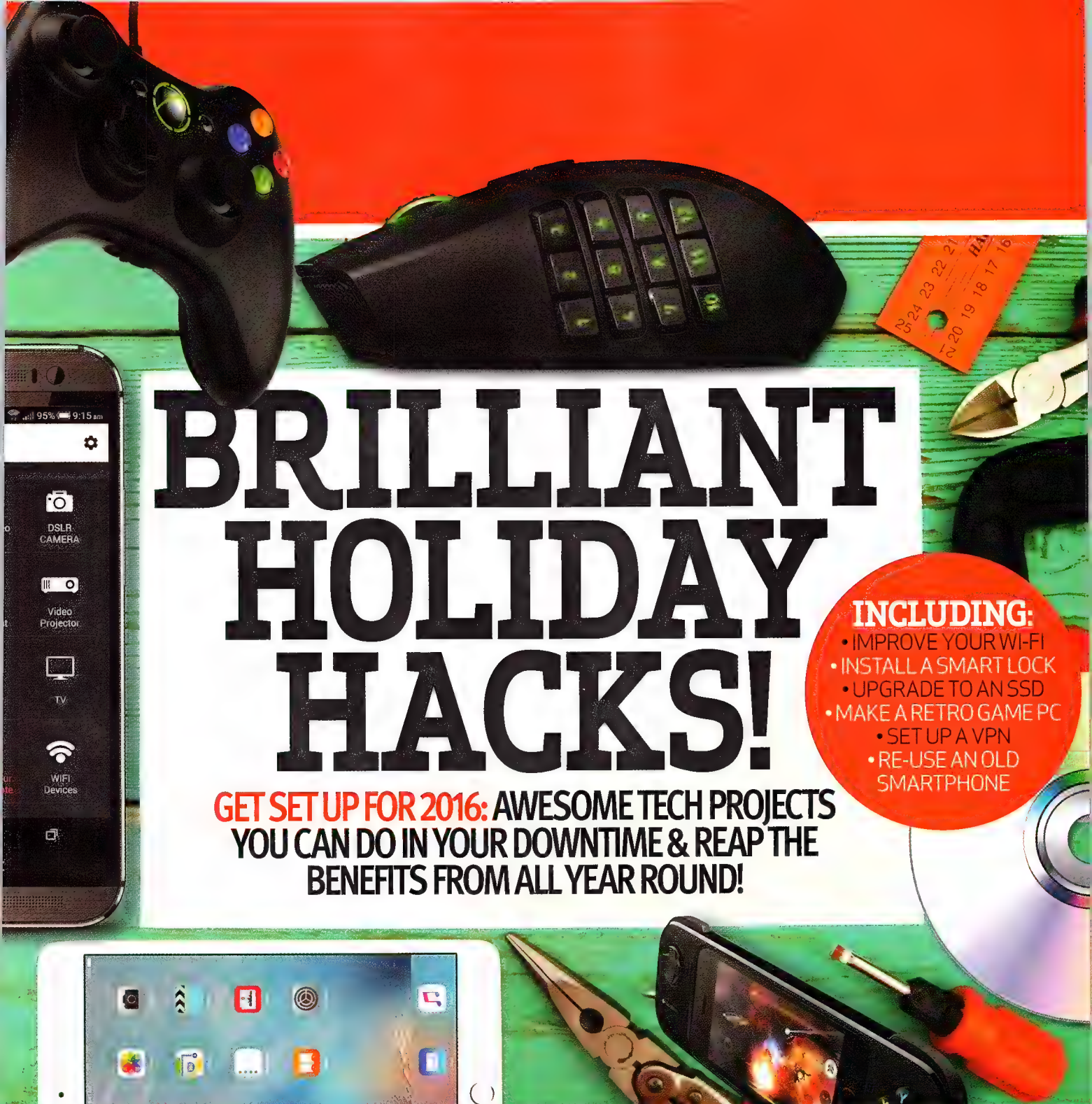
The most interesting feature of Drawpile is, of course, its collaborative element. Under the Session menu, you'll find options to host a new session or to join an existing one. Hosting a session is simple thanks to Drawpile's built-in server, which the application uses automatically for local sessions. A user only needs to provide a title and a login/password pair that other users can use to join a session.

In a standard LAN, Drawpile will create a hosted session with an IP of 192.**.* or 10.**.* pattern, but Drawpile can also make local sessions available over the Internet. You just need to right-click the IP address shown in the lower right-hand corner and select the "Get externally visible IP address" option. Once you host or join a session,



a standard chatting area appears at the bottom of the window. Drawpile can also record user sessions in its own proprietary DPREC format. This isn't a screencast, but rather a handy tool to replay actions that have been performed in Drawpile before.

Alexander Tolstoy



BRILLIANT HOLIDAY HACKS!

GET SET UP FOR 2016: AWESOME TECH PROJECTS
YOU CAN DO IN YOUR DOWNTIME & REAP THE
BENEFITS FROM ALL YEAR ROUND!

INCLUDING:

- IMPROVE YOUR WI-FI
- INSTALL A SMART LOCK
- UPGRADE TO AN SSD
- MAKE A RETRO GAME PC
 - SET UP A VPN
 - RE-USE AN OLD SMARTPHONE

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DIY SOLAR BACKUP POWER

Blackouts will be a thing of the past with this small-scale off-the-grid system.

Repurpose an old smartphone

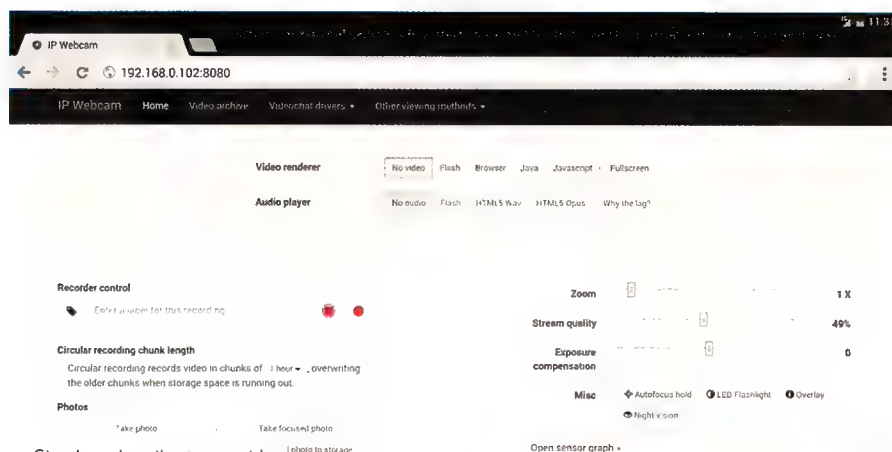
Don't let that spare phone go to waste! Here's how you can put it back to work in a wide variety of ways.

While it might lag playing Candy Crush, an older smartphone is still a tiny, powerful computer that can be useful in many ways. Better yet, the projects we've collected here generally won't cost you a thing. Android is a particularly flexible platform for phone-repurposing, but many apps also have iOS and Windows Phone equivalents.

IP SECURITY CAMERA

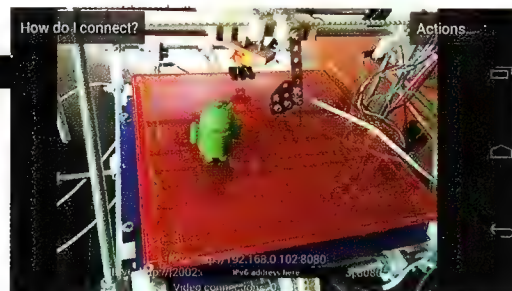
Wi-Fi-connected remote cameras with battery backup are crazy expensive. But an old phone is all that, plus has a built-in light, microphone, speaker, data connection and more. An IP Camera can be used for tasks from monitoring the dog while at work, to being part of a bigger motion sensing security system.

The key to getting started is an Android or iPhone app called IP Webcam (www.ip-webcam.appspot.com). This lets you remotely access the camera over the network or Internet. You can also use the



Simply and easily stream video over a network or the internet using IP Webcam.

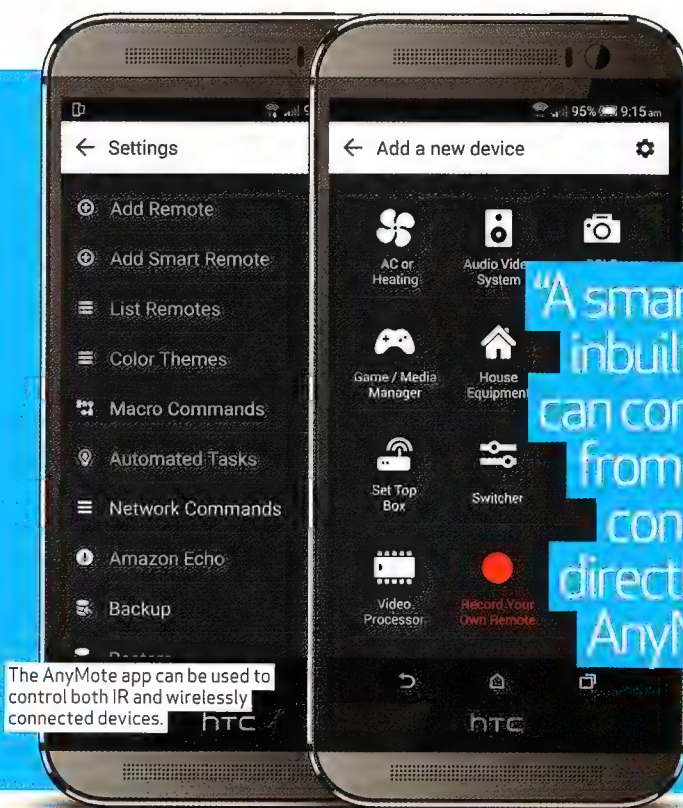
microphone, speaker and LED flash. Other free and paid apps can motion activate, record video and send alerts. Get a cheap car mount for the phone to help get the right viewpoint, and make sure it's plugged and charging.



Touchscreen remote

Universal remote systems such as the Harmony range from Logitech are great, but expensive. With a few handy apps, you can turn an old phone into a Wi-Fi connected control system.

For Android users with a Chromecast, most major apps such as Netflix (www.netflix.com) and YouTube (www.youtube.com) can be simple to cast to a TV. Free apps such as LocalCast (www.localcast-app.com) can stream media from a NAS. If you run an HTPC, VLC (www.videolan.org) has a range of apps available to give remote control. A smartphone with inbuilt IR blaster can control devices from TVs to air-conditioners directly, using the AnyMote app (www.anymote.io). G-mote (www.gmote.org) (or iTunes Remote (www.itunes.com)) can be used to control a PC or Mac directly, from music and movies to operating as a Wi-Fi touchpad and keyboard.



The AnyMote app can be used to control both IR and wirelessly connected devices.

"A smartphone with inbuilt IR blaster can control devices from TVs to air-conditioners directly using the AnyMote app."



CAR OR BIKE COMPUTER

Instead of buying an expensive GPS speedo, an app such as GPS Speedometer (www.binary-toys.ch) turns that spare phone into a powerful measurement system. Get an accurate speed, check your elevation, record trip distances and time, and get limit warnings. By downloading offline Google maps (www.maps.google.com) on Wi-Fi, a smartphone can also be used as a dedicated GPS unit.

For car use, an app such as Torque (www.torque-bhp.com) can turn a smartphone into a dedicated car computer. Linking with a Bluetooth OBD reader, you can monitor your car engine, check fold codes, watch sensor data and set alarms for issues such as overheating. The app can also measure acceleration and record info from track racing.

ADD WIRELESS CHARGING TO (ALMOST) ANY PHONE

Potentially one of the most handy, yet often overlooked features of a smartphone — wireless charging — is fairly easy to retrofit. Both receivers and charging pads are super affordable, and, together, can cost under \$20. Having to plug in a cable each night might not seem like much of a chore, but wireless charging is more about always being topped up. The chargers are so cheap that it's easy to have one next to the bed, in the car, on your desk at work or in the living room. Popping your phone down on a pad, rather than just a table, means it will almost always be fully charged throughout the day.

PHONE TYPES

Many phones (such as some Samsung's, the LG G4 and more) actually have provisions for wireless charging to be added. It's as simple as finding the right receiver — eBay (www.ebay.com.au) has a huge selection. From there, it's as easy

as popping off the back cover, sticking the receiver in place and putting it all back together. This is the ideal way to add wireless charging, as it means the USB port can still be used as normal. Not many phones have this option, but always check to make sure.

UNIVERSAL CHARGING RECEIVERS

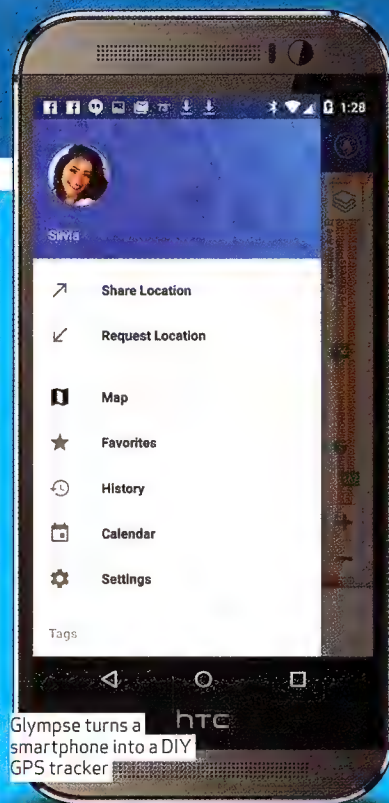
For other devices without an upgrade option, you need to get a little more creative. Fortunately, it's possible to buy a variety of receivers that can be fitted to almost any phone. The catch is that, for many phones, you either have an ugly pad stuck on the back, or need to cover it all up with a case. USB Type-C users are out of luck, at least for now. For some phones (such as the iPhone), it's also possible to buy cases that have Qi charging built in.

THE OPTIONS

The universal charging receivers come in a range of different types, and it's critical to get the right one for your specific device. iPhone users have it easy — since all the phones are very similar, it's as simple as searching for an iPhone compatible model. Android (and to a lesser extent, Windows Phone) users on the other hand have a large array of options. The problem is the location and orientation of the Micro USB port. Depending on the model, it can be on the side (high or low), on the bottom, or offset from the middle. The port can also be orientated in either direction. Fortunately, there are a huge range of receivers available to suit most phones.

INSTALLING

The receiver simply plugs into the phone's charging port, then is curled around to lie flat against the back panel. Then the unit is carefully put into a case to hold it all in place. In our testing, the charging works through even thick



GPS tracking bug

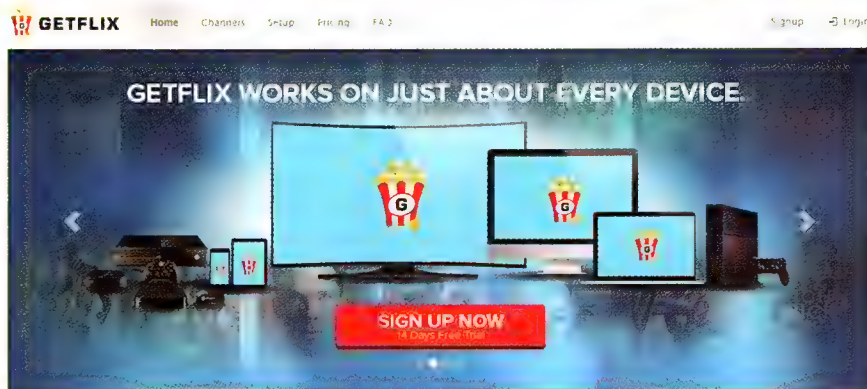
Instead of becoming a privacy bug, GPS tracking is probably better suited to your own security instead of an expensive surveillance system.

Combined with a cheap pre-paid sim-card, a smartphone can be used to remotely check the location of a stolen car or boat. Newer iOS and Android phone can be tracked through an account, but apps such as Glympse (www.glympse.com) give a greater range of options such as logging or movement alerts. With a car charger, a phone can be hardwired in a hidden location and won't ever run out of power. Otherwise, coupling a phone to a high capacity power bank and putting it in a sealed container gives a bug that can operate for up to many weeks away from the charger.

wallet style cases, but can be blocked by metal. With some phones with a removable back cover, it can be possible to tuck the receiver pad inside, leaving just a thin ribbon cable out to the charging port.

OTHER DEVICES

Wireless charging is not just limited to a phone — it's possible to add to all sorts of devices. Tablets, eBook readers, cameras, power banks, Bluetooth speakers and more can all benefit, just make sure you pick a suitable receiver module to match. Another excellent use is that old phone being used as a remote. Keep a charging pad by the TV and the remote has a home that keeps it always topped up.



What is Getflix?

Getflix allows users from Australia, New Zealand and all over the world to easily access global video and music streaming services. Getflix uses Smart DNS technology to bypass the geo-blocking and open up this amazing world of entertainment.

Watch the latest movies, TV series, children's shows and classic titles from multiple devices including PCs, game consoles, mobile phones, tablets and more.

How does it work?

Streaming services use a technique called geo-blocking to restrict access to their services to certain countries. They do this by looking up the country of origin of your internet address (also called an IP address). Your IP address is your unique address on the internet, much like a phone number.

Getflix gets around this geo-blocking by re-routing certain connections via our US servers, so they think you are actually located in the US (since they see our server's IP address instead of yours).

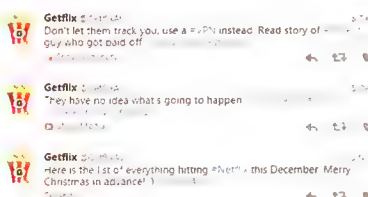
Our service is super fast as only a small number of connections get re-routed via our servers. The actual video and music is streamed from the streaming service directly to you so Getflix is much faster and more reliable than an alternative VPN.

Most importantly, your regular internet browsing and privacy is completely unaffected. Find out more in [How it Works](#).

Why Getflix?

- Access ALL popular global streaming services from anywhere around the world
- Choose from 20+ regions from the world's most popular streaming service
- Easy to use Smart DNS technology
- Free, optional VPN account with all paid subscriptions
- Fast and friendly 24x7, 365-day support
- Works on all of your favorite devices, no software to install
- Low monthly pricing, no commitment and cancel anytime
- Free sign-up with our 14-day trial, no credit card required

Getflix Twitter Feed



A Smart DNS such as Getflix can be a cheaper option than a VPN for bypassing geo blocks.

Set up a VPN

Protect yourself from metadata collection and other snoops with a VPN.

At its most basic, a virtual private network is a secure link between your computer or home network, and a server connected to the Internet. The result is that all your data is encrypted and can't be read by any third party, such as your ISP or a hacker. It also means that any online activity can't be linked back to you personally – the trail stops at the VPN provider. The reputable ones don't keep any logs either, which gives excellent online anonymity. With all the government plans to (potentially) monitor our Internet and block certain websites, VPNs are becoming increasingly popular. While some free options are available, a good VPN typically costs about \$10 a month.

VPN VS SMART DNS

One common use for a VPN is bypass geo restrictions. For example, Netflix (www.netflix.com) in Australia does not have the same selection of content as Netflix in America, but it automatically detects your location. A VPN server can be located

anywhere (and in some cases, can be switched between locations), making it appear you are in a specific country of choice. The thing is, a smart DNS service can perform the same task, can be faster and is usually cheaper. In contrast, though, it does not provide any of the security benefits – it simply changes your perceived online location. A smart DNS service also often has better compatibility with streaming devices, such as smart TVs, and doesn't require any software.

CHOOSING A VPN

Data going through a VPN is only as safe as the company providing the connection, so stick with well-known brands. Since all your data has to be routed through a server, reliability and high speeds are also very important. Many VPN services offer a free trial, so you can try before you buy. Check the reviews – the very popular free Hola VPN service (www.hola.org) was discovered to be using its user's bandwidth to route paid traffic, and selling the network to unscrupulous organisations.

PUREVPN

One of the fastest options available, PureVPN (www.purevpn.com) has software for Windows, Mac, iOS and Android, as well as compatibility with many existing consoles and streaming devices. PureVPN has servers around the world and can be run on five devices at once. Buying a year upfront costs about \$6 a month, while month-to-month is around \$14.

THE SMART DNS ALTERNATIVE

Getflix (www.getflix.com.au) is one of the more popular services to access geo-blocked content around the world. Signing up for a year gives prices as low as \$3.75 a month, or \$5.5 if paying month to month. It also has a free 14-day trial. Getflix doesn't need any software installed, and has detailed instructions on setting it up on most popular devices.

BE WARY OF DNS LEAKS

While a VPN should give total anonymity, a DNS leak can sometimes reveal your true IP address. The problem is caused when your computer accesses the Internet outside of the secure VPN tunnel, rather than routing all traffic through it. DNS leaks can be detected by going to a tester website, such as www.dnsleak.com. If you do have a leak, the website has instructions on closing it up.

Improve your Wi-Fi

Don't settle for a sub-par wireless experience — use these helpful techniques to improve your setup.

Despite working really well the majority of the time, Wi-Fi can be a fickle beast. Most homes have at least one inexplicable black spot or strange interference. Fiddling with the router and angling the antennas can help, but improving reception in one spot inevitably reduces it somewhere else. Fortunately, with a bit of free software, a laptop or smartphone, and some science, you can map, analyse and improve your network.

MAKE A WI-FI HEATMAP

There are two main heatmapper options, either using a smartphone or laptop. In our experience, the laptop-based software is higher resolution, and the larger Wi-Fi antenna more accurate. The smartphone apps are generally simpler, and quicker and easier to use but create a more basic map. Both systems connect to an access point, then measure and record signal strength, before overlaying it on a floor plan.

TELSTRA WI-FI MAXIMISER

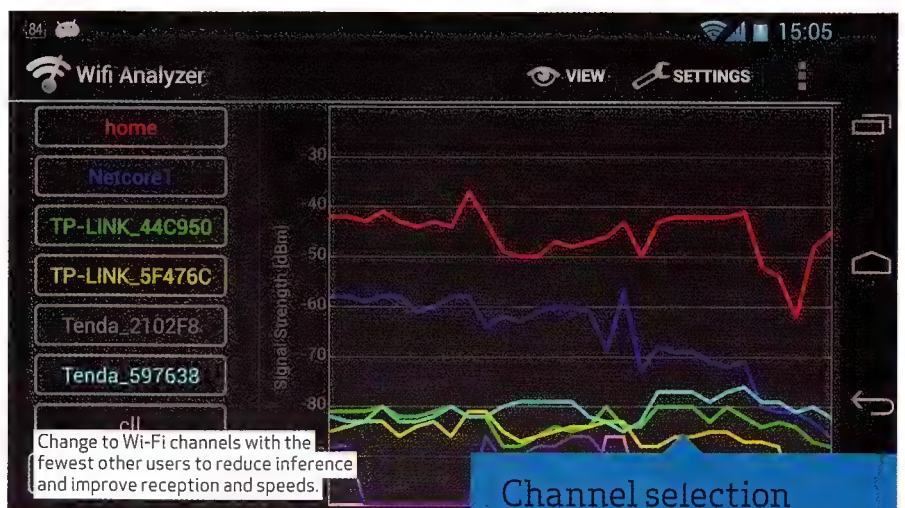
WWW.TELSTRA.COM.AU

This free Android and iOS app was one of the more reliable tested. That said, there are a lot of options available. The app can measure and display signal strength in real time, as well as create a heatmap. The process is pretty simple — you draw a basic floor plan of your house, and the app imports it via the camera or as a file. To map, you touch where the router is, then walk into each part of the house, touching your location each time. The app will then create a heatmap of Wi-Fi strength, helping find any dead zones.

EKAHAU HEATMAPPER

WWW.EKAHAU.COM

This free Windows software is designed to run on a laptop. After loading a floor plan image, using the software is as simple as walking around your house, clicking the map when standing in certain spots. More selections takes longer, but gives a more accurate map. Try and cover as much of the room as possible, not just the edges. The program will automatically place your router



location, based on signal strength. It will also map other nearby Wi-Fi devices that could be causing interference.

IMPROVE YOUR WI-FI

Examine the heat map to see where the signal is strongest, or if it is being blocked. Try repositioning your router, or even just the antennas, to overcome a black spot. Generally, the best spot is in the middle of the house and up high, but walls can block signals in varying ways. Even if it is not possible to remove a black spot, it might be better to have it in the hallway, rather than the bedroom. Sometimes, walls or interference will mean reception can't be improved passively. Instead, target such areas with a wired network, or Wi-Fi repeater. 5GHz Wi-Fi can also help, but is often more easily blocked by walls.

Channel selection

Many Wi-Fi issues can be caused by interference, especially from other routers.

One of the biggest issues is simply other devices (such as a neighbour's router) using nearby Wi-Fi channels. Devices automatically pick a channel, but because of how the frequencies work, nearby ones actually overlap slightly. The app Wi-Fi Analyzer (www.a.farproc.com/wifi-analyzer) scans the available channels and gives a graphical representation of the signals on each channel. It also shows which channels are the least used, and any potential overlap. Logging into your router and manually changing to the least occupied channel will decrease interference and improve speed.

Install a smart lock

Step through a digital doorway into the future.

Keys are painful but mostly necessary devices that are part of our everyday life. But thanks to modern tech, there are smarter options for your front door. Better yet, digital locks are easily installed by just about anyone.

PICKING A SMART LOCK

The Kwikset Kevo (www.kwikset.com/kevo) is one the more affordable smart locks and can be easily found for under \$300 in Australia and it's what we've used for this tutorial. The unit replaces a traditional deadbolt with a battery-powered digital system. Using Bluetooth from a phone, or included key fob, the lock knows when you are nearby. Simply touching the lock face tells the system to unlock, or relock when you leave. It's smart enough to know if you are inside or outside, so a stranger can't unlock the door just because you are nearby. It's also got a traditional key system that can be used even if the batteries go flat.

TESTING AND IN-USE

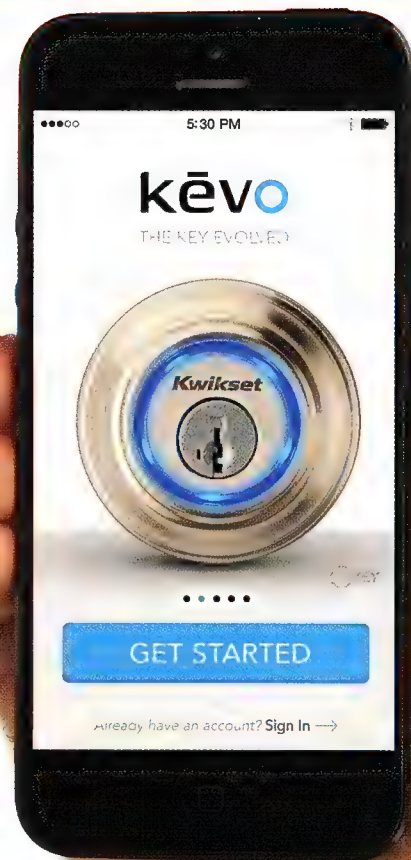
The Kevo never failed to unlock for us, but it takes a few seconds to check the

Bluetooth and move the actuator. The advantage is that your keys can stay in a bag or pocket, so it's faster, even if it feels a bit slow.

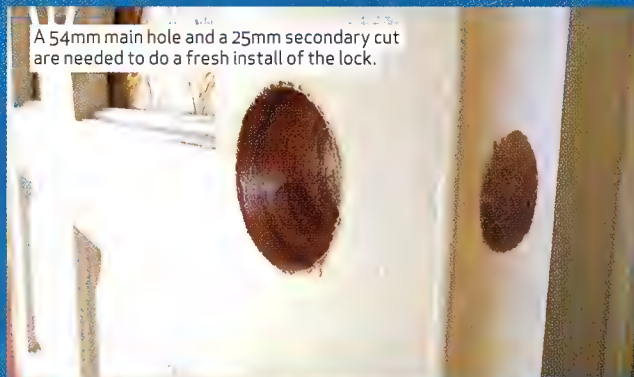
The smart part of the lock mostly comes from the phone app, rather than the lock itself. The system lets you track who has opened the door — though this is limited to phone connections, not the fob. You can also create and send special e-keys to other people. These can be programmed to allow others (using the app) to enter your home using their own smartphone. The e-keys can be set for specific times, have an expiry date or just be deleted remotely. For example, you could create a key that works for your neighbour only while you are away, or gives a cleaner access at specific times. The system can also interface with a Nest thermostat.

In our testing, the Kevo system worked perfectly, even with phones or fobs in a bag or pocket. Having to leave Bluetooth on and the app running in the background does increase battery usage, but not by a lot.

All in all, the Kevo is a solid all round smart option.



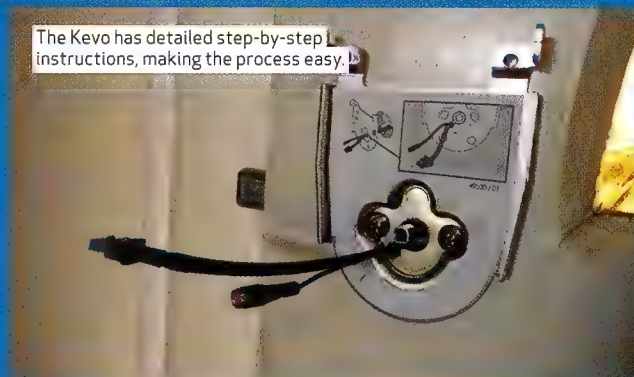
The Kevo can be opened with an included fob (or normal key) but connecting to a smartphone is needed to access all the smart functionality.



A 54mm main hole and a 25mm secondary cut are needed to do a fresh install of the lock.

1 MEASURE, MARK AND CUT

The Kevo comes with a comprehensive guide to installing it, with all the measurements needed. Even simpler, it has a paper template that can be used — but care needs to be taken to double check it all lines up. For our install, we cut a 54mm hole through the door, with the centre 60mm back from the edge. A 25mm hole was also bored in from the door edge, centred from the edges and lining up with the middle of the 54mm hole. Using a chisel (and a Stanley knife for fine work) a few mm deep indentation was cut out for the mounting plate.



The Kevo has detailed step-by-step instructions, making the process easy.

2 INSTALLING THE KEVO

The locking mechanism is inserted into the 25mm hole first — check it all works and nothing binds up. The outside portion of the lock is placed through the central keyway, with the wires running under the unit. Next, a mounting bracket is installed on the inside, and the wires carefully routed into a slot designed for them. Plugging the wiring into the lock is the trickiest part, and care needs to be taken not to put too much pressure on it, or clamp the cables in the wrong way. Pay special attention to the smaller signal wire — the joining plugs need to be tucked into the lock body and are an awkward fit. From there, the lock body is hooked onto the bracket (make sure the latch is facing up) and screwed into place.

DIY INSTALL

The Kevo Kwikset is designed to fit into the same size hole as a traditional deadbolt. That said, only a small number of real world deadbolts that we examined were in any way traditional, and a direct swap is not always possible. In our case, the existing deadbolt was an entirely different design. While it would have been possible to remove and modify the door to fit the Kevo, it was easier to simply do a fresh install above the existing deadbolt. The lock comes with a full install guide, but by running through the process ourselves, we can give some tips on what to watch out for, and give some idea of the process. If you have any doubts, check out the Kwikset website before buying – all the install and setup guides are available. There is also a very handy video guide on YouTube.

THE TOOLS YOU'LL NEED

For those lucky enough to already have the correct deadbolt holes, the Kevo can be installed with as little as a Philips head screwdriver. It's not a tricky process, and would take less than 30 minutes. With our install, a range of extra tools were needed. A power drill is a must-have, as well as a 54mm hole saw to cut out the main mounting hole. A smaller 25mm hole also needs to be drilled with a spade bit, for the actual locking mechanism. A chisel is also required to make a mounting plate cut out.

Other smart locks

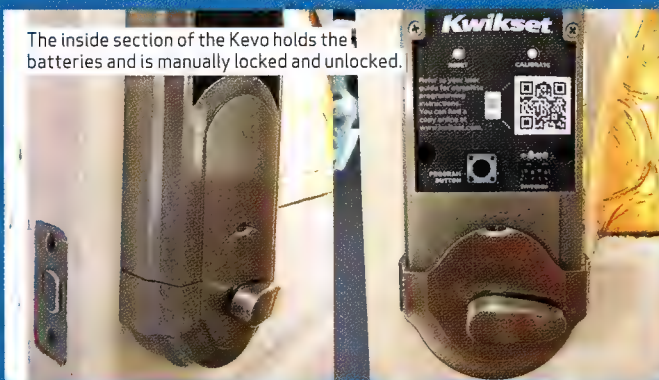
The Kevo isn't the only option out there, though it is one of the cheaper, more established and easy to use systems.

The downside is that some of the smarts (such as tracking entries) revolve around the app, and don't work with the fob or keys. That said, it can be upgraded with Kevo Plus, an internet connected option gateway option. Other more expensive systems give extra options such as the ability to remotely monitor and lock / unlock a door via the internet, or connect into other home automation platforms. There are also locks that support biometric fingerprint entry, or PINs.



The Kevo can be retrofitted in place of many existing deadbolts, otherwise new holes are needed.

The inside section of the Kevo holds the batteries and is manually locked and unlocked.



3 PREPARE FOR USE

The lock is initialised by holding down the program button, whilst inserting the batteries. After a beep, releasing and pressing the button again causes the lock to power through an open/close cycle to learn if it's a left- or right-orientated install. The keys can be used immediately, and the lock is operated from inside by a physical latch. If you have an existing compatible Kwikset key (say, from another lock), the Kevo can be 'reset' to use that key instead.



4 PAIRING AND CALIBRATION

The digital fob included with the Kevo is already paired to the lock – you simply have to push its enrol button. Connecting a phone is as simple as downloading the app (Android or iOS) and following the onscreen instructions. It will also walk you through the calibration process, which lets the lock learn to tell if you are inside or outside the house.

Picking the right SSD is important, especially when it comes to size and interface.



Install an SSD

Dropping an SSD into an older computer is one of the easiest ways to get a significant performance boost.

PICK YOUR SSD

Size (and, by extension, cost) is one of the most important considerations when installing a new SSD. That 1TB is very tempting, but could be overkill unless you need a lot of high-speed storage. Instead, consider a smaller SSD, and a large secondary HDD — external, if upgrading a laptop. Your existing drive might also make a great secondary drive.

The second consideration is speed. Check what interface your computer uses — there is no point buying a high-end performance model for an older, slower laptop SATA interface.

CLONE, WIPE OR UPGRADE?

Before messing around with drive upgrades, back everything up, ideally to an external HDD, with key files also in the cloud. Don't ever rely on cloning software or upgrades to work 100% — there is always a chance your data could be lost.

CLONE

Cloning an existing drive is, in many ways, the simplest option, but has some

downsides. Essentially, the software makes a perfect copy of your HDD onto the new SSD. From there, you simply need to install it, and boot up like nothing ever happened. Many SSDs come with cloning software, and some even have USB to SATA adapters to make the process even easier. The problem is that cloning doesn't always work correctly, and can make the new system unstable. It's also more complex to clone limited parts of a drive — for example, if the old HDD is bigger than the new SSD.

A FRESH INSTALL

The best results usually come from a new copy of your OS. Remove the old HDD if upgrading a laptop and put it in an external USB case. For a desktop, just add the SSD to the system, and install a fresh copy of the OS from a USB drive. The handy part here is that your original drive remains unchanged, and your files remain available. It also means if there is a problem with the SSD or new install, it's still possible to boot up on the old drive.



A USB to SATA connector is handy when cloning a laptop drive.

UPGRADE

As a free upgrade, Windows 10 (www.microsoft.com) brings a new, slightly complex option into the mix. Performance is generally better on older hardware and, considering the price, it's worth doing. The catch is your existing OS needs to be upgraded (which can very rarely cause issues or data loss) — you can't do a clean install. The best method is to clone your existing drive to the new SSD, then upgrade that. If there are any problems, the original drive remains as is and can be cloned again. Once the OS is upgraded (and activated online), it's possible to do a fresh install. It's important to upgrade and activate first, otherwise the new Win 10 install won't verify as a legit upgrade.

CLONING SOFTWARE

The most common software included with SSDs is Acronis True Image (www.acronis.com). Often a slightly older version, it nonetheless does the job pretty well. While there are a number of paid cloning tools out there, free options are just as good. AOMEI Backupper (www.backup-utility.com) is one of the best options, with a simple-to-use interface that leads first time users through the process. It's also got plenty of more advanced options (and other backup features), as well as a paid Pro version with even more disk management features.



Despite the weird name, AOMEI Backupper is one of the best free cloning programs available.



Get your retro game on

Put an old device to use as a dedicated retro-gaming machine.



The excellent Xbox 360 controller is widely supported by emulation software.

Retro gaming can be a whole lot of fun and, these days, it's actually super easy to get started. You can use a HTPC, old laptop or dedicated minicomputer, but there is also another option. That old tablet or smartphone is more than powerful enough to run a range of emulators. Not only does it give an easily portable option with screen, there are a range of ways to output video to the TV. It's even possible to hack a PSP to run classic games.

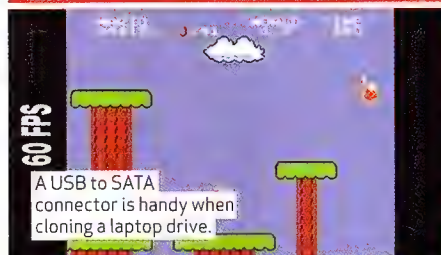
FINDING OLD GAMES

One of the biggest issues with retro gaming is actually downloading the games. A ROM (Read Only memory) is a copy of the original classic game. While emulation software is freely available, the original game files range from legally available, to still being protected under copyright. ROM collections are available on torrent sites, but almost certainly contain copyrighted material. Some people are happy to only download ROMs of games they also physically own, but that's still generally illegal under copyright laws, or a murky grey area at best. To stay above board, stick to public domain or legally available ROMs. A good starting place is www.pdroms.de, but watch out for dodgy sites that promise free ROMs.

An increasingly popular alternative is retro games that are released legally for sale or download on platforms such as Steam (www.steampowered.com) or through gaming consoles. Good Old Games (gog.com) has a huge range of older games available for purchase.

GET IN CONTROL

It's possible to buy retro gaming controllers that have been updated to USB, but classic is not always better. One of the favoured choices is the Microsoft Xbox controller (www.microsoft.com), which can be bought relatively inexpensively as a wired or wireless option and is supported by most emulators. For arcade-style gaming, it's hard to go past the Razer



Atrox (www.razerzone.com). The Logitech Powershell (www.logitech.com) is also an interesting way to turn an old iPhone (along with emulator software) into a portable gaming machine.



Lakka is a standalone USB installed emulating OS that makes retro gaming easy.

RetroArch

Back by the way, you can find a wide range of retro gaming software available for download at (www.libretro.com) or (www.mt32.com).

It can run on just about any device, from iOS and Android to consoles, Raspberry Pi, a PC or Mac. It's also got a huge community and is constantly being updated. The downside is that RetroArch can be a little daunting for beginners and isn't just a simple install and play option. Once you get the hang of it, though, RetroArch allows total customisation to get that favourite old game running exactly as remembered. After downloading and installing RetroArch on your system of choice, you need to install emulator cores — available via online updater menu option. The best options vary based on your operating system and platform; for example, the Nestopia UE core is a solid choice for NES games. From there, it's just a matter of loading up games from your library of ROMs. For computer use, Lakka (www.lakka.tv) is a custom Linux distribution based on RetroArch that makes the whole process simpler. Compatible with pretty much any new or old PC (or Raspberry Pi) via USB, Lakka has all the emulators you need pre-installed, as well as an easy to use interface.

DIY solar backup power

Blackouts will be a thing of the past with this small-scale off-the-grid system.



Don't expect to save enough power to make a profit, but solar can be an excellent backup.

"Building or buying a totally off the grid solar system that can run an entire house is very expensive because it needs to run high draw items such as cooking appliances and aircon."

A big solar array on your roof is great and all, but the system ultimately still relies on the grid. Battery systems such as the Tesla Powerwall can keep things running when the power is off, but are expensive and (mostly) still need external power to charge. Building or buying a totally off-the-grid solar system that can run an entire house is very expensive because it needs to run high draw items such as cooking appliances and aircon. Instead, it's simple and relatively cheap to build a small-scale off-the-grid solar system that can be used to save money and provide an emergency backup for critical gadgets.

THE THEORY

A large majority of your favourite technology runs on low DC voltages, or uses relatively small amounts of power. For comparison, the amount of juice needed to run an air-conditioner for an hour could keep a smartphone alive for a year. Even powerful laptops sip watts compared to a desktop PC. It's also worth noting that, when the power goes out, the Internet likely still works, if only the modem wasn't off.

Using a single affordable solar panel, it's easy to collect enough power to run a small, independent backup system that can charge phones, laptops and run other small appliances, and keep them going for as long as the sun keeps coming up. We have opted for a 250w solar panel, coupled to a 100 Ah deep

cycle lead acid battery. The system can handle multiple cloudy days and is also completely scalable. Only want to run your modem off grid, or charge a phone? The same principles apply, just substitute a smaller 40W solar panel and 7AH battery.

THE PARTS

The entire project can be built with off-the-shelf parts from somewhere such as Jaycar electronics (www.jaycar.com.au), but plenty of money can be saved if you shop around online, especially eBay (www.ebay.com.au).

SOLAR PANEL (250W/12V)

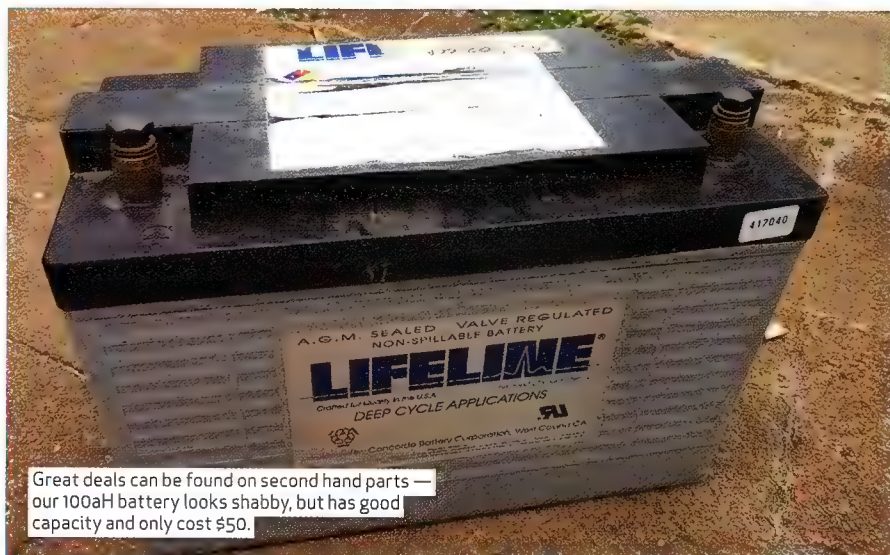
It's important to get a 12v (not 24v) panel. In most of Australia, the panel should produce upwards of 1,000 watts for a day of sun. 250W panels are some of the most affordable per-watt as well. **COST:** \$225

SOLAR REGULATOR (20A/12V)

This unit takes the slightly variable solar output and modulates it to create a stable output, as well as charge your battery. It will display charge level, and will automatically disconnect the load to protect the battery if the voltage drops too far. Newer than ours shown, the CY1220 is ideal. **COST:** \$30

DEEP CYCLE BATTERY (12V/100AH)

A deep cycle battery is important, so it is not damaged by ongoing days of use when cloudy. Multiple batteries can be



Great deals can be found on second hand parts — our 100Ah battery looks shabby, but has good capacity and only cost \$50.



The solar regulator uses the captured electricity to charge the battery and regulate the output load.



A cigarette adaptor is an easy way to power compatible 12v devices, such as USB car chargers.

connected together to increase the capacity.
COST: \$250

CIGARETTE LIGHTER SOCKET ADAPTER

An easy way to connect 12v devices to the solar system. Use 12v car accessories, such as laptop and USB chargers for better efficiency.
COST: \$15

INVERTER (12V/150W)

Run small appliances, such as laptops, directly from 240v. Upgrade the wattage for larger power draws, such as a TV. For sensitive equipment, use a full sine wave inverter.
COST: \$30

OTHER ITEMS

Cabling, connectors, heat shrink, mounts. Use appropriate-sized wiring and robust connectors to ensure a reliable system.
COST: \$100

THE COST

A powerful 250W total system can cost as little as \$650, and gives some of the best bang for buck when comparing cost to power produced. A smaller 40W system could cost as little as \$150, but will be quite limited.

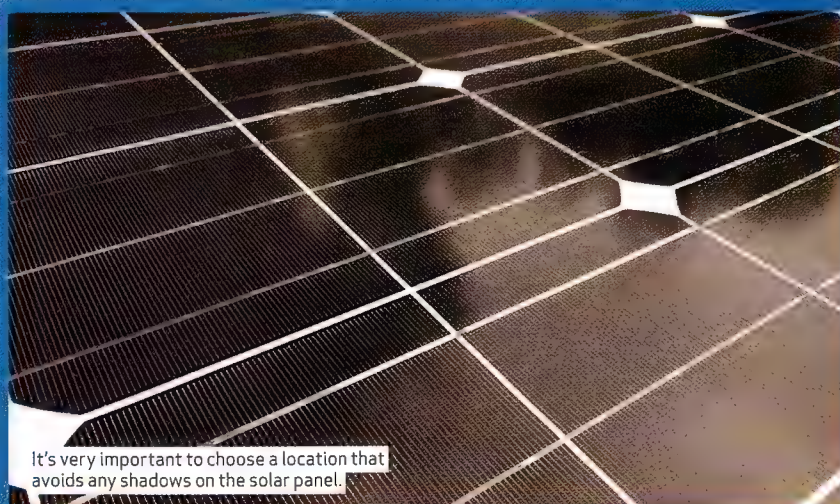
Unless you really utilise the system heavily, a mini solar setup won't save much off your power bill. Solar is all about how long it will take to pay back the initial investment, and depending how heavily it is used, this system would take 10 to 20 years to pay for itself. In this case, it's more about having a backup system, plus building a cool holiday project.

THE SKILLS

Messing around with solar is easier than you might think. There are no high voltages and all the equipment is off the shelf. Most connections have screw terminals or plugs, so soldering is not necessarily needed. The wiring is simple, and instructions are included with the solar regulator. The hardest part is mounting the solar panel itself — say, on a garage roof. Depending on your location, it could also be mounted to a fence, or a pole in the backyard.

FUTURE UPGRADES

A 250W, 100 Ah system has excess capacity to run extra devices. While most low-power 240v devices can run through the inverter, direct 12v is more efficient. A handy idea for extra off-the-grid functionality is emergency 12v LED lighting. You could also power up LED Christmas lights, use the system as a UPS or run small constant loads such as fountains.



It's very important to choose a location that avoids any shadows on the solar panel.

1 SELECTING A LOCATION

The solar panel needs as much uninterrupted sun as possible. Even partial shadows are a no no, and will drastically cut into the power produced. Solar angle calculators online will help find the best orientation for the panel in your specific location. Good locations for the panel include on top of a garage or house roof, but care needs to be taken during installation. Make sure you have enough cable to run back to the regulator. The battery will be heavy, so needs to be somewhere out of the way.



Most of the parts use plugs or screw terminals and are very easy to connect together.

2 THE WIRING

While the regulator, inverter and plugs can be left loose, it's a good idea to attach them to something solid, such as a block of wood. This allows you to create a solar charging station that can be easily used, or upgraded in the future. For compatible modems (check the rating on the back), a cigarette lighter to 12v DC plug adaptor can be used.

3 A CHARGING STATION

The digital fob included with the Kevo is already paired to the lock — you simply have to push its enrol button. Connecting a phone is as simple as downloading the app (Android or iOS) and following the onscreen instructions. It will also walk you through the calibration process, which lets the lock learn to tell if you are inside or outside the house.

4 TESTING

When in the sun, the regulator will show the solar panel is producing electricity, as well as the current state of battery charge. More complex regulators can give a digital readout of the exact voltage and power levels.

Are you **BATTLE-READY?**

OCZ SHIELDPLUS
WARRANTY

NO Shipping costs and **NO** hassle
with **ADVANCED** replacement.



Trion 100 Series
Entry-level Users

- ▶ Max Read: 550 MB/s
- ▶ Max Random Read: 90,000 IOPS
- ▶ Endurance: 27 GB/day
- ▶ 3 Years ShieldPlus Warranty



Vector 180 Series
Enthusiasts

- ▶ Max Read: 550 MB/s
- ▶ Max Random Read: 100,000 IOPS
- ▶ Endurance: 50 GB/day
- ▶ 5 Years ShieldPlus Warranty
- ▶ Cloning Software & 3.5" Desktop Adapter

OCZ's ShieldPlus Warranty available for all Trion 100, Vector 180, ARC100, Vertex 460A and AMD Radeon R7 drives.

BACK TO SCHOOL

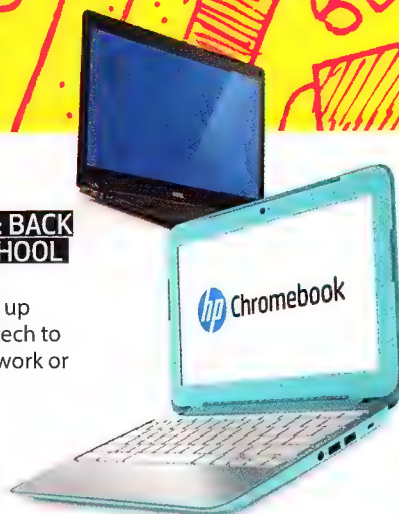
Get your year off to a great start with the right gear for heading back to school... or work! APC tracks down the best budget laptops and rounds-up 2016's must-have productivity tech.



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BEST TECH GUIDE: BACK TO WORK AND SCHOOL ESSENTIALS

Lindsay Handmer digs up the best productivity tech to make getting back to work or study that bit easier.



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BEST-EVER BUDGET LAPTOPS

Just in time for the return to action, we look at some low-cost laptops suitable for school-goers... or anyone that's looking to save a buck.



Best tech guide: Back to work and school essentials

Lindsay Handmer digs up the best productivity tech to make getting back to work or study that bit easier.

These days, going to school, uni or holding down most jobs requires fairly intensive use of technology. Even if it's possible to get by on the basics, there are a range of devices that can improve productivity, not to mention just make getting through the day easier.

Our favourite gadgets range from noise-cancelling earbuds to tablet styluses, and fast USB drives to smartwatches. A comfortable yet tough bag designed specifically to carry a range of gear is also a must have.

Windows vs Apple debate aside, the core way for most to get things done is with a laptop. Going a full day on battery is possible, and ideal, since it lets you leave the charger at home. Look for 12 hour + ratings and assume less. Shutting off Wi-Fi and dimming the display can help eke out extra hours. For lighter loads, a tablet with a keyboard can replace a laptop – or look for crossover devices such as the Microsoft Surface. Depending on your

job or study, high-end hardware might not actually be needed. For Internet access, word processing and other basic applications, it's possible to get away with lower-end models. Not only does this save money, you often get better battery life. Don't forget about apps either – a smartphone or tablet can be so much more thanks to a huge array of free and paid apps. Apple products are generally well supported by schools and universities, but in a weird contrast, the web browser of choice is often Internet Explorer.

In the past, many businesses preferred to supply computers, but bringing and using your own device (BYOD) is a growing trend. The disadvantage is in needing to buy the gear, but it also gives a lot more flexibility to use it as desired outside of work.

One of the most important considerations is getting through an entire day without running out of power. Sure, it can be possible to find a wall socket, but power banks give a lot more flexibility. For smartphones,

3,500mAh is about the minimum, while tablets need a 5,000mAh or better model that supports 2.1A fast charging. For laptops, 20,000mAh models are typical, but they can also charge via USB. The tricky part is making sure it has the right changeable tips to suit your specific model.

Students should always check discounts before purchases, especially with software. For example, some universities in Australia offer free Microsoft Office licences to students, or even discounted tablets. Also consider salary sacrifice, which can be used to purchase and save tax on portable electronic devices used for a job.

When eying what juicy new bit of tech to buy, consider how it will make your job or study easier. If it's not getting used most days, or saving significant time, there is probably a better option. But don't forget about downtime either – getting to relax and unwind with an eBook or movie on the commute home is just as important.



\$199 | WWW.AUDIO-TECHNICA.COM.AU

Audio Technica ATH-ANC40BT

Get some peace and quiet with these noise-cancelling earbuds.

There are plenty of big bulky over-the-ear style noise-cancelling headphones, but they are far from discrete, let alone very portable. The ATH-ANC40BTs are in-ear models that promise to reduce background noise by 90%. They are Bluetooth as well, and can connect to (and shift between) two devices at once and operate as a hands-free.

The headphones fit comfortably in ear (and come with multiple cup sizes), though the round-the-neck control side is a little bulky. Audio quality from the 13.5mm drivers is excellent, with a rich sound with plenty of bass.

The difference in passive noise cancellation is noticeable compared to over-the-ear style units, but when switched to active, the world becomes a much quieter place. Repetitive droning background noise is all but eliminated, and other sounds pleasantly reduced.

Battery life is a decent eight hours (or 24 when just noise cancelling), and they come with a 3.5mm cable just in case you run out of juice.



\$149 | WWW.OFFICEWORKS.COM.AU

Comsol 20,000 mAh Power Bank

For the serious on-the-go gadget lover.

Smaller USB-only power banks are essential to making it through a busy day away from a desk. But if you want to boost the battery life of a laptop, a monster like the 20,000mAh Comsol is needed.

While it has a 2.1A USB connector, it can also output 19V (or 12/16v) for a laptop. It comes with a range of tips to suit different models, and manages up to 3 amps. While the Comsol worked perfectly on most laptops we tested, it can't run the latest from Dell. To put the capacity in perspective, it can recharge a smartphone about 10 times over. Depending on the laptop, it should more than double the run time, while a tablet can be brought back two or three times.

The Comsol power bank charges from a 19V PSU in about four hours (though also works on some laptop supplies), which is much faster than USB, but not as convenient for travel.



\$35 | WWW.MICROSOFT.COM

Microsoft Sculpt Mouse

Better than a trackpad.

Some people are trackpad wizzes, while others need a mouse for fine control. There are countless portable mice available, but the Sculpt manages to roll everything into one excellent yet affordable package. It uses Bluetooth, so no dongle or spare USB port is needed. While there is a smaller Sculpt Portable, the 111mm-long and 68.5mm-wide Sculpt Comfort sits better in the hand. The mouse is geared towards Windows users, with a touch and gesture-sensitive button/panel under the thumb that has a range of programmable functionality (and haptic feedback) such as swapping between apps. That said, it will work with OS X and Android, but not iOS. The mouse also has a tilt scroll wheel, which gives both horizontal and vertical scrolling. The Microsoft BlueTrack technology is excellent, and the mouse works accurately on just about any surface — bar some glass.

The Sculpt uses two AA batteries (included), which last about 10 months.

Verdict

Versatile noise-cancelling earphones that can really help concentration.



Verdict

The ultimate way to make it through a long day away from the charger.



Verdict

Best for Windows users, but even so, a lot of mouse for the money.





\$69.95 | WWW.LOGITECH.COM

Logitech K380

A keyboard for all your devices.

Tablet cases that double as a keyboard are all well and good, but don't tend to make extended typing very enjoyable. The K380 aims to be a much more productive unit, while also being able to connect to a range of devices. It uses Bluetooth 3.0 and can connect to Windows, Mac, Chrome OS, Android and iOS. So from smartphones, to tablets or just as a mobile laptop keyboard, the K380 is the go-to. You can pair to and switch between up to three different devices as well.

The Logitech keyboard is full size, but fairly small at 124mm x 297mm, but unless you have very large hands, it's solid and easy to type on. It does weigh in at 423 grams, which is great for typing, but perhaps a little too much in a bag. It comes with two AAA batteries, which will last about two years, provided you switch the keyboard off between uses.

Logitech also has the slightly larger K480, which includes a built-in tablet stand.



\$57 | WWW.SAMSUNG.COM/AU

Samsung Flash Drive DUO

High-tech portable storage.

Despite us living in a world of cheap or free cloud storage, bandwidth contrast means portable USB drives are still very important for larger files. The Samsung model is a little pricier than the el-cheapo models available, but for good reason. For a start, it's got an all metal (aside from the cap) body for extra durability. It's also fast, and on the 64GB model, using USB 3.0, we managed 121MB/s reads and 93MB/s write speeds. The DUO part of the name comes from the fact the stick also has a USB Type-C port. Not overly common just yet, the new connector is the way of the future and is showing up on all the latest laptops, smartphones and tablets. If you don't want the extra functionality, the drive also has a sibling, the BAR, which is just a standard design, with the same performance. Both are backed by a five-year warranty.

The DUO costs \$28 for the 32GB, \$57 for 64GB and \$97 for 128GB.



\$300 | WWW.WDC.COM

Western Digital My Passport Wireless

Make backups and storage simple.

Be it for work, school or uni, having a backup is critical. Depending on your project, large storage space is often needed and the cloud doesn't always cut it. USB 3.0 gives fast transfers, but it's not always convenient and can slow sharing and collaboration. The WD My Passport makes life simple with an inbuilt battery and Wi-Fi that can connect to eight devices at once. It's 802.11n, not AC, but has a 2T2R antenna for up to 300Mbps connection speeds. The maximum real-world wireless speeds we saw were similar to the USB connection, around 100Mbps reading and writing. Not only can the drive be set to back up all your devices, it can pull photos off a Wi-Fi-equipped camera, or access them via the inbuilt SD card reader. The drive can also be used to stream media, and has an excellent iOS and Android app for management.

Under heavier use, battery life is as low as five hours, but it can be charged from USB.

Verdict

A little more bland than some, but you can buy it outright.



Verdict

A premium USB drive that is well worth the extra cost.



Verdict

A versatile and powerful data backup and sharing system.





\$89 | WWW.ADONIT.NET

\$149 | WWW.AOCMONITORAP.COM



FROM \$549 | WWW.APPLE.COM

Adonit Jot Dash

Try a simplified active stylus.

Taking digital notes can be a great way to improve organisation and save time. Passive styluses make it possible to write and draw directly onto a touchscreen, but the results aren't always very accurate. The Jot Dash improves accuracy by using a very fine 1.9mm tip fed a slight electrical charge that mimics a finger on the screen. It also works on laptop trackpads.

The Jot Dash feels just like a normal pen and gives a much better result than a plain stylus. The battery lasts 14 hours, and is charged via a funky magnetic USB clip. The trade-off is that the Dash is not connected to your device in any way, so no extra functionality such as pressure sensitivity or palm rejection. The good part is that it works with any touch-sensitive device without any extra setup.

For those who want extra functionality, Jot also have the Script and Touch, which actually link to the device in use.

AOC E1659FWU

Double your productivity with this USB monitor.

There are some tasks, such as research, that are made a whole lot easier with a second screen. The 15.6-inch AOC E1659Fwu is the portable answer, running completely off USB. The biggest downside to the screen is the low 1366 x 768 resolution – though there is a more expensive 1080p coming soon.

Using the display is easy – install the Display Link software and plug it in. Image quality from the TN is average, with a vibrant, bright feel and reasonable viewing angles. The response time is 8ms, and we had no issues with ghosting or lag over the USB connection. The screen does use significant power, though, and will reduce battery life by a few hours.

The display has a fold-out stand for both portrait and landscape mode. The whole unit measures in at 233mm x 372mm x 23mm and weighs 1.2kg – about the same as an Ultrabook. It comes with a protective sleeve, and is easily slipped into a laptop bag.

Apple iPad Air

Tablet form productivity.

Despite the versatility and choice of Android, the iPad is still the go-to choice for best compatibility across the Australian education system. Web-based logins, systems and assessments are tested to work with them and there is generally a larger range of apps available. Some unis and courses even hand them out to students for free.

The choice then comes down to the iPad Air, vs the Air 2. Both are quite pricey, but opting for the older model can save a few hundred dollars if you shop around online. While both are the same size, with a 264ppi, 2048 x 1536, 9.7-inch screen, the 2 is a little thinner, and has an updated processor. Of course, if you want to run particularly demanding apps (think 3D modelling), then the newer model is the best bet.

When it comes to options, cellular data is probably overkill – Wi-Fi is easy to come by, or it can be tethered to a smartphone.

Verdict

A simplified active stylus for improved digital note taking.



Verdict

Affordable and portable enough to be worth adding to your gear.



Verdict

The best choice for compatibility and productivity.





\$250 | WWW.LIVESCRIBE.COM

Livescribe 3 Smartpen

The digital future of analog notetaking.

Despite the growing use of laptops and tablets at school and work, still nothing is quite as easy as jotting down notes with a pen. Livescribe have been slowly merging the physical and digital worlds and the latest Smartpen does it better than any other (so far).

The chunky but comfortable device writes like a premium pen (and the ink cartridge is changeable), but scans every letter or drawing as you go with an inbuilt camera. It's very easy to use – just take notes as normal and the Smartpen saves a local copy, as well as beaming them across to a connected Android or iOS smartphone or tablet. Using your device's microphone, it can also record audio Pencasts, such as lectures, and lets you play back from the exact time you made specific notes.

There is a catch to the Smartpen, though – it only works with special dotted paper from Livescribe (about \$10 for an 80 page A4 notebook) though you can also print your own at home.

Verdict

Expensive, but still easily the best way to digitise and access your written notes.



\$350 | WWW.LG.COM

LG Watch Urbane

Stylish notifications on your wrist.

Smartwatches are a bit of a "love them or hate them" affair, but undeniably are useful productivity and organisational tools. A reminder buzz on the wrist is less intrusive than pulling out a phone, and a subtle glance at the wrist isn't an interruption.

The LG Watch Urbane is one of the better implementations of Android Wear and looks enough like a traditional watch to blend in.

The Urbane uses a gorgeous 1.3-inch P-OLED screen, which is bright and vibrant. It uses a Snapdragon 400 CPU with 512MB of RAM and 4GB of eMMC storage. The battery easily makes it through a day of heavy use, and it has an inbuilt heart rate monitor and can work as a fitness tracker. The bands are interchangeable with other watches and is water resistant.

One cool feature of the Urbane is that it can connect to a Wi-Fi network and remotely receive notifications from your smartphone – even if you left it at home.

Verdict

Design tastes vary, but the Urbane is a solid middle ground smartwatch.



\$1,195 | WWW.MINIPROJECTOR.COM.AU

HyperMaxx WF Pro

This mini projector gives you big-screen capabilities on the go.

From presentations, to a second screen or even just relaxing with a movie, a mini projector is very useful.

The HyperMaxx beams out a massive 300 lumens – enough for a 100-inch screen just by flicking out the lights (or 200-inch in total darkness), or a TV-sized one in a brighter room. The projector has a built-in battery too, and can run for about 90 minutes, or longer using a laptop universal power bank. It measures in at just 180mm x 110mm x 28mm and weighs 520 grams, making it very portable.

The HyperMaxx has a native resolution of 1280 x 800, a 2,000:1 contrast ratio and a 20,000-hour LED bulb life. Media can be fed in via HDMI, VGA, AV or played directly from a USB or microSD card. You can also mirror a device's screen via Wi-Fi, or stream media from a DLNA server.

Picture quality is pretty good for such a small unit, and the inbuilt 3W speaker is loud, if somewhat tinny.

Verdict

High-quality portable projection worth the cost.





\$299 | WWW.STMBAGS.COM.AU

STM Drifter Energy

A versatile tech-ready bag with a difference.

A tough yet roomy bag to transport and protect your laptop, tablets and other gadgets is very important. The STM boffins have taken one of their most popular bags and added a charging station that can juice up USB devices. Sure, you could use a separate power bank, but the STM system is tucked out of the way, and has smart functionality such as overheat protection.

The bag itself has a large main storage area of 18L, as well as a padded slip that can hold a 15.6-inch laptop. There are also smaller secondary slots for tablets, smartphones and other devices. Up top, you get a see-through mesh bag (good for chargers) and a myriad of other pockets, storage areas and loops to keep everything organised and in place.

Importantly, the bag is extremely comfortable, even when loaded up, with foam pads and adjustable straps. It also has rain cover, and a rear strap to hold the bag in place on existing wheeled luggage.

Verdict

An amazing gadget-ready bag, but the Energy option is overpriced.



\$500 | WWW.SEAGATE.COM

Seagate Personal Cloud 2-Bay

Easy backups and remote file access.

There are NAS boxes with more features, or better apps, or that are cheaper – but the Seagate Personal Cloud is a great-looking, bang for buck option without going overkill. It's available in both a 2 Bay model (from \$500), or a 1 Bay version (from \$250), with capacities starting at 3TB, up to 8TB. We tested the dual drive model, which allows RAID for performance or extra redundancy.

The Seagate uses a Marvell ARMADA 370 CPU, 512MB of RAM, has Gigabit Ethernet, USB 2.0 on the back and USB 3.0 on the side. Transfer speeds are plenty for day to day use (up to 103 MB/s read, 76 MB/s write) and the system is super easy to get up and running. It has the usual NAS functionality – streaming media, auto PC/mobile backups, cloud storage syncing, remote access and a range of extra apps, such as Plex. The Seagate smartphone app is well put together, and available on Android, iOS and Windows Phone.

Verdict

A simple but effective consumer NAS with strong media streaming functionality.



APC's favourite apps for getting things done

Tasker

This Android app costs \$2.99, but can be used to create intelligent automation. Automatically set to silent when at work or uni (or set locations), change notification importance based on time or even automatically send an SMS if running late. For iOS users, a similar app to Tasker (www.tasker.dinglich.net) is Workflow (www.my.workflow.is).

PDF scanners

Use a smartphone or tablet to quickly snap a picture of a document and turn it into a PDF. The app automatically adjusts contrast and brightness for legibility and can sync to cloud storage. Try Tiny Scanner (www.appxy.com) on Android or iOS.

Cloud services

Never forget a file again as your data automatically syncs across all devices. Cloud services such as Google Drive/Docs (www.google.com/drive) also have powerful sharing and collaboration tools. Dropbox (www.dropbox.com) is one of the most widely supported cloud services, but iCloud (www.icloud.com) and Microsoft OneDrive (www.onedrive.live.com) are also excellent. ■



Best-ever budget laptops

Just in time for the return to action, Nathan Taylor's tested a batch low-cost laptops suitable for school-goers... or anyone that's looking to save a buck.

It's that time of the year again: the time when the kids head back to school and you have to equip them for the year ahead. That likely means, among other things, that you'll be looking at a new laptop. And given the high probability of said laptop being lost, mistreated or misused, you'll want something that doesn't break the bank.

To that end, this month, we decided to take a look at a suite of low-cost lappies suitable for kids (or adults who just want something on the cheap). The products include traditional laptops, convertibles and detachable with screens ranging from 11.6 to 14 inches, and we aimed for laptops under \$500. All but two of the laptops below cost less than that, and some are available for as little as \$300. We also looked at both Windows laptops and a few of the new Chromebooks — the latter built to be cloud-centric, extremely easy to use and very hard to mess up.

The best news is that we were very pleasantly surprised at the quality of low-cost laptops on offer. None of the products below looked or felt cheap, and the build quality was surprisingly great across the board. The days of getting an absolute clunker appear to be behind us.

Of course, you can't expect miracles. While the designs and build qualities were surprisingly good, you can't expect powerhouse internals. By and large, these are devices that are simply no good for 3D games and feature low-speed Celeron processors and minimal memory. Most even eschew hard drives, expecting you to rely on cloud storage and flash memory to take up the slack — you may find installing

apps when you have only 14GB of storage available can be a rough business. Wireless support, even where 802.11ac is available, tends to be of the minimalist sort. Not a single product below supports MIMO, for example, and some 802.11n products cap out at just 72Mbps.

Still, for cloud-centric operations, they proved more than capable — and plenty enough for school kids to create, research and communicate as they need to.

HOW WE TESTED

For the Windows laptops, we used an app called PassMark PerformanceTest 8 (www.passmark.com), and app that performs tests on the CPU, memory, disk, a graphics subsystems using DirectX and Windows features. It gives aggregate scores for those tests, and we've listed the results for the overall PassMark Rating as well as the CPU, 3D Graphics and Disk score. Higher is better.

For Chromebooks, PassMark is not an option, so we instead used Google's Octane JavaScript benchmark (developers.google.com/octane). Octane hits a web browser with a variety of JavaScript tasks and times how quickly it executes those, which gives a comparative indication of how well a device will handle web-centric operations (like embedded Word Processors, for example). We ran

Octane from within Chrome, and the higher a device scored the better.

All devices were tested with the mains power connected, which allowed the Intel processors to go into 'Turbo' mode. Running the benchmarks on battery power often produces lower results.

WINDOWS ON A BUDGET

Most of the laptops we looked at for this feature still run good-old Windows, most having been upgraded to the new Windows 10. If you're not pushing it too hard, Windows 10 runs just fine in 2GB of memory, though it can chug with lots of tabs open or memory-intensive applications running.

For convertibles and detachables like the ASUS Transformer Book Flip and Toshiba Satellite Click 10, it also has a fine tablet mode, which can be configured to automatically jump to if you convert/detach the screen. Apps using the new UI introduced in Windows 8 will work just fine in that mode, but just like in Windows 8, many traditional desktop apps don't like tablet mode so much. Buttons are often too small to target with a finger, on-screen keyboards cover essential parts of apps and context menus and the like can be hard to access. Just be warned — your old apps may not work that well in tablet mode.

CHROMEBOOKS

	DELL CHROMEBOOK 11 (3120)	HP CHROMEBOOK 11 (Y07G CI)	LENOVO THINK- PAD YOGA 11E (20DB0008AN)
GOOGLE OCTANE	8456	7654	7174

BUDGET WINDOWS LAPTOPS

	ACER ASPIRE ONE CLOUDBOOK 11 (AO1- 131-C605)	ASUS EEEBOOK E402MA (WX0032T)	ASUS TRANSFORMER BOOK FLIP TP200SA (FV0120TS)	HP STREAM 11 (D008TU)	KOGAN ATLAS 14 X14FHD	TOSHIBA SATELLITE CLICK 10-C00H
PASSMARK 8 OVERALL SCORE	513.7	659.9	543.5	588.3	746.7	606.4
- CPU MARK	687	1783	767	845	2123	1432
- 3D GRAPHICS MARK	247.9	166.6	254.1	187.3	166.2	217.7
- DISK MARK	745	468	639	702	641	671



\$298 | WWW.ACER.COM.AU

Acer Aspire One Cloudbook 11 (A01-131-C60S)

Beautiful, and incredibly good value.

To get a laptop's price under \$300, one has to make sacrifices. The Acer Aspire One Cloudbook 11 manages to make them and still be a laptop that's most definitely worth owning.

Of special note is the beautiful design — a thin and light shell reminiscent of premium laptops. The screen, despite its limited resolution, is sharp and large enough for most common use. The keyboard is comfortable to use and fast, and the touchpad is capacious for a laptop with an 11.6-inch screen.

On the other hand, it's no surprise that Cloudbook 11 has the bare minimum specs required to run Windows 10. A 1.6GHz dual core Celeron and just 2GB of shared graphics/main memory drive the laptop, and the only internal storage is 32GB of eMMC flash memory, half of which is taken up by the operating system and (thankfully) a small handful of pre-installed apps. This is a

laptop designed for cloud operation, although given that fact, it was disappointing to learn that it also only supports the bare minimum 802.11n Wi-Fi. Sitting less than a metre away from our router, it connected at just 72Mbps and couldn't even see the 5GHz network.

As you might expect, given these specs, it did not perform well in PassMark, and after running the test (which would have tripped the Celeron into Turbo mode), there was a little too much heat coming from the bottom of the laptop. Still, that was pushing the laptop as hard as it can go, and for more moderate use, Acer claims that the device can last up to eight hours on a single charge of the battery.

Verdict

The performance isn't great, but the design and value is.



\$597 | WWW.ASUS.COM.AU

ASUS EeeBook E402MA (WX0032T)

A full-size laptop with a great design.

If you're looking for a more conventional laptop than some of the small-screen portables, the ASUS EeeBook 402MA offers both style and portability.

With a 14-inch screen (but weighing a modest 1.65kg) and a unique style, the EeeBook 402MA offers a lot of bang for your buck. Configurations vary, with models with different processors and internal hard drives up to 1TB. The specific model we tested and listed the specs for, the WX0032T, actually breaks the \$500 rule, but there are versions of the E402MA with lesser processors and smaller hard drives that easily make it under the threshold. It comes in at as little as \$350 for the WX0031T.

Whatever the internal spec, we love the EeeBook E402MA's external style. This is one great looking laptop, featuring a screen with a modest resolution but clear visuals, an excellent, comfortable keyboard with

plenty of palm-rest space and a large and responsive touchpad. There are two USB ports to work with, as well as an Ethernet LAN port and a VGA port in addition to the HDMI port.

There are, of course, sacrifices made for the price. The processor isn't exactly a powerhouse, and it only uses Intel HD graphics. There's a little too much junkware pre-loaded, the Ethernet port is of the slowest kind, and the Wi-Fi support is very limited — it only works in the 2.4GHz band and at a maximum of 72Mbps, which is pretty weak in this day and age.

Nonetheless, it's a solid full-size laptop, with a great design and enough performance to get everyday tasks done.

Verdict

In spite of the 14-inch screen, it's very portable. It's also a pleasure to use.





✓✓✓
apc
RECOMMENDS

\$498 | WWW.ASUS.COM.AU

ASUS Transformer Book Flip TP200SA (FV0120TS)

It sure is pretty. And functional, too.

Like Lenovo's Yoga (p59), the ASUS Transformer Book is a convertible, with an 11.6-inch touch screen that rotates around the body 360 degrees, turning the laptop into a tablet-like slate. Unlike the Yoga, however, it's incredibly light and frankly quite the looker in silver and crystal. The downside to this lightness is that the device can feel a little flimsy, especially the keyboard half – but we guess that's the price you pay for trimming weight. The biggest drawback is the lack of stiffness in the screen hinge, which can start to wobble in laptop mode with the slightest provocation; even vigorous typing or touchpad click will have it shaking.

The screen and keyboard are otherwise fabulous – especially the screen, which is wonderfully responsive to touch input. In fact, the general ergonomic design is excellent, as good as a much more expensive laptop.

Like the most of the devices here, however, its internals aren't going to set the world on fire. It runs a 1.6GHz dual core Celeron, and has just 2GB of memory and 32GB of internal storage (though ASUS do kindly provide an additional 32GB microSD Card in the box, for a total of 64GB). There are two regular USB ports as well as one of the new type-C USB 3.1 ports. It also supports 802.11ac, connecting to our AC network at 433Mbps.

Aside from our concerns about the strength and stability of the screen hinge, the Transformer Book Flip is a wonderful product. It's light, looks fantastic, runs well enough for basic use and is flexible enough to be both slate and laptop.

Verdict

Gorgeous and light, but the hinge is a worry.



✓✓✓
apc
RECOMMENDS

\$298 | WWW.HP.COM.AU

HP Stream 11 (d008TU)

Fun colours and a solid build.

HP made quite a few waves when it first announced its brightly coloured Stream laptops. Here, we had what many of us had waited for: an eminently affordable, cool looking (if you don't mind colours so bright they verge on garish) cloud-centric laptop with a good build quality and excellent features for kids.

The Stream has more competition now than when it first launched, but it's still an excellent buy. It's well designed and comfortable to use and with just enough oomph to get the job done.

In terms of specs, it actually tips similar-priced laptops slightly. Its Celeron 2840 processor is a touch faster than that of the Acer Aspire One, for example, and it also boasts an HD webcam and 802.11ac support up to 433Mbps. It's rather heavier and chunkier than the Aspire One, however – indeed, it's nearly as heavy as the 14-inch ASUS EeePC.

As with all the devices that come with just 32GB of storage, you're pretty hard up for storage space on the HP Stream 11, having only about 14GB of available storage once Windows 10 is accounted for. Thankfully, the laptop does come with a one year subscription to Office 365, as well as 1TB of online storage for 12 months, provided by HP. A few other apps are supplied by HP, but nothing worth really keeping on the system.

Even with some notable competition, the HP Stream is still a very good product, and one of the best value back-to-school solutions available today. It's absolutely worth considering.

Verdict

A little heavy perhaps, but a good build, good specs and great value.



✓✓✓
apc
RECOMMENDS



\$359 | WWW.KOGAN.COM.AU

Kogan Atlas 14 X14FHD

Incredible value.

Although the design is neither as well thought out or as slick as the competition, it's impossible to argue with the value of the Kogan Atlas 14. For just \$359 (or \$369 for the 4GB model), it offers specs and features that are superior to more expensive alternatives: a faster processor, 802.11ac wireless, support (up to 433Mbps), a 500GB HDD, and a full HD 14-inch screen with quite decent viewing angles. Sure, it's not 'high-end', but it's better than anything else we've seen at this price.

It clearly hasn't had the design work put into it that the ASUS EeeBook has; it's frankly kind of ugly, and the ports are in weird places – primarily near the front of the laptop, which means you'll have a bunch of cables sticking out from under your wrists if you're connected to anything. The touchpad is also a little less responsive than we would like, although we found the

keyboard absolutely fine for high-speed typing. It's heavier than the ASUS EeeBook, but it also feels a lot more solid, with a suitably stiff hinge and heavy plastic casing.

We tested this device under Windows 8.1 ('cause that's what it came with), and as expected, it performed somewhat better than the rest of the competition – especially in CPUmark, thanks to its superior processor. However, its 3D performance was a bit of a let down. This is still not a laptop that you can play games on (good, if you want your kids to do their homework). Even so, for the price, it's certainly a top pick, and well worth the investment.

Verdict

It's not a perfect design, but in terms of bang-for-buck, it's tough to beat.



apc
HOT PRODUCT



\$598 | WWW.MYTOSHIBA.COM.AU

Toshiba Satellite Click 10-C00H

A Surface alternative at a very reasonable cost.

Okay, we have a confession to make: we let Toshiba cheat on this one. The Satellite Click 10-C00H breaks our price rule by a little less than \$100 – but we let it slide because this is definitely worth looking into.

For a start, it's a detachable, a 10.1-inch tablet computer that docks with a (supplied) keyboard base. That base, in addition to including a very good keyboard and responsive touchpad, also includes two USB 2.0 ports and an additional battery that pushes the device's total battery life to an impressive 15 hours. Without it, the tablet will last about nine. The keyboard battery will charge automatically if the tablet is attached and charging.

The meat of the device is in the tablet, and that includes 4GB of memory, a quad-core Atom processor and 64GB of storage (14GB of which is taken by Windows 10). The tablet

itself has a full HD 10.1-inch screen, which does feel a little too small when attached to the keyboard. The generous bezel could have easily accommodated another inch of screen size. That said, the screen is fantastic, and the touch elements are tactile and responsive. Even as a pure tablet, it's a great product. In tablet mode, it also weighs just 550 grams, which is comparable to an Android tablet or an iPad.

The Atom processor that drives it isn't tremendously powerful, but was more than enough for web browsing and similar light operations. The tablet did get a little warm at the back when benchmarking, but nothing to be concerned about.

Verdict

A great tablet, and a very good laptop.



Considering a Chromebook

All the Chromebook pros and cons you need to be aware of.

Chromebooks are becoming an increasingly popular choice for school kids. They're designed to work largely in the cloud, using a trimmed-down operating system and minimal local storage. The expectation is that you'll use (Google's) cloud services for storage, productivity and communication.

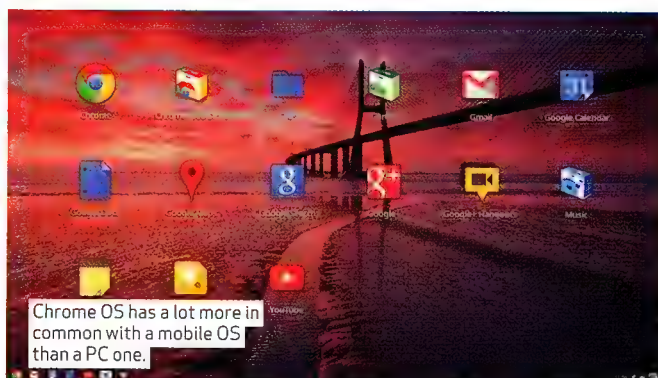
If you're not familiar with Chrome OS, then you should know that it's an extremely simplified OS built around the Chrome browser. By and large, the browser is the interface – even system settings are managed through the browser interface. You can install other apps on it including Spotify and music apps, Netflix, Plex and other media apps, games, weather and outdoor apps, health and fitness and so on. There are thousands of options available in the Chrome Web Store. But these are much more like mobile apps than

desktop ones, and a lot of them are really just launchers for web sites.

Even more so than a mobile OS like Android or iOS, it's made to be very easy to use and largely idiot-proof. You can't easily mess with settings or fudge things up.

Because the OS is so streamlined (it's built on a trimmed-down Linux kernel), it doesn't require a lot of horsepower to run. A processor that would chug on Windows will often be perfectly snappy in Chrome OS, and 2GB of memory is actually plenty unless you really want to load a lot of apps into memory. Because it keys into Google cloud services and local apps tend to be quite small, you're not required to have much local storage. 16GB is common and that typically leaves you with about 10GB for app installs.

"Chrome OS is an extremely simplified OS, built around the Chrome browser."



\$462 | WWW.DELL.COM.AU

Dell Chromebook 11 3120

Tougher than most.

In contrast to the consumer-friendly styling of many Chromebooks and under-\$500 laptops, the Dell Chromebook 11 is all business. It's elegantly styled in black and grey, with a dense design, spill-protection and rubber trimming that makes it look and feel quite a bit tougher than most of the competition.

Indeed, the Chromebook is sold in Dell's business section, rather than the consumer store, and has gone through mil spec ruggedness testing. The only issue we really had with the design was the slightly raised touchpad, which felt a little unresponsive and made dragging and dropping a little painful (not that you need to do much of that in Chrome OS).

It also features a few specs that one-up most of the competition. Where most Chromebooks have webcams limited to VGA resolution, Dell offers 720p.

802.11n Wi-Fi is the order of the day on most of the rest; the Dell supports 802.11ac.

It also uses a processor with a higher clock speed than most, but only two cores. At least for the Google Octane benchmark, that pays off – it rated notably higher than the quad-core processors used by Lenovo and HP.

Although people looking for something with a little more zazz may be tempted to go with one of the more colourful or fancy Chromebook designs, the better specs and rugged build of the Dell make it our top pick right now. It won't die when your kids mistreat it, it performs just a little bit better than the rest, and it comes with 100GB of Google Drive storage for two years.

Verdict

It's built tough without being heavy, and has solid specs that we'd like to see in more Chromebooks.





\$399 | WWW.HP.COM.AU

HP Chromebook 11 (Y07G C1)

It may look like a toy, but it has the goods.

The soft colours and Fisher-Price styling of the current model HP

Chromebook 11 may make it look like a kids' tool, but the HP Chromebook 11 is absolutely solid, with well designed parts and a perfectly snappy interface. It's light without feeling flimsy; the keyboard feels great for rapid-fire typing; the screen has a limited resolution but excellent viewing angles; and the touchpad has just the right amount of sensitivity. It is, quite simply, a nice design all around.

Unfortunately for prospective buyers, HP sells the Chromebook 11 in an absurd array of different specifications, some of which even use ARM processors in lieu of Intel ones. For the record, the model we tested had one of the higher-end processors in use for the Chromebook (the Celeron N2940), but a number of models with lesser processors and cheaper prices are available.

The model we tested performed very well indeed, in both the benchmarks and in general operation. Web pages loaded and rendered smoothly, and we were able to have more than a dozen tabs open without experiencing any major slowdowns or hiccups. That's as much a testament to the efficiency of Chrome OS as it is the hardware of the Chromebook, but either way, as a browsing device, the Chromebook 11 gets top marks.

Ultimately, as Chromebooks go, the HP doesn't have a huge amount that sets it apart from the competition, but it does have a robust and light design that should appeal to many users. A good choice overall.

Verdict

A great option for Chrome OS fans.



\$483 | WWW.LENOVO.COM.AU

Lenovo ThinkPad Yoga 11e (20DB0008AN)

Bigger and heavier than it has to be.

The ThinkPad Yoga 11e uses the Lenovo Yoga design – the laptop screen rotates a full 360 degrees around the hinge, turning the device into a slate. It's even stiff enough to be configured in a upside-down V, so that the keyboard base functions as a stand. It's also built tough, with a rugged bumper around the screen and base that's perfect for the rough treatment schoolkids are likely to deliver.

Unfortunately, it's also larger and chunkier than it should warrant – there's a very large bezel around the screen, and it's quite a bit heavier than competition with a similar screen size. It can also be a little weird to use on your lap in slate form – the keyboard is on the bottom, and you have the disconcerting feeling of constantly pressing keys on your knees.

The touch screen and keyboard are both well-designed, with excellent feel

and responsiveness – although the touchpad did feel a little off when we used it (not that that matters as much when you have a touch screen to work with).

The quad-core Celeron processor was perfectly snappy for Chrome OS, and while 16GB of storage doesn't sound like much (and you only have about 10GB for your apps available), you can expand the storage capacity with an SD Card or USB device. The four-cell battery is rated for about 6.5 hours of life.

It should be noted that we tested the 20DB0008AN model (sometimes listed as 20DB000BAN), but there are a variety of different models available, some with more memory or 802.11ac and Ethernet support.

Verdict

A solidly built convertible. But it's rather chunkier than we would like.



2016 TECH PREVIEW

Over the next 12 months, our notion of what a computer is and how we interact with it will change. But that's just the start of what's to come — this year is shaping up to be a pivotal one for graphics, processors, storage... pretty much everything in fact.

By the APC staff



TECH PREVIEW 2016: VR & AR

THE YEAR IN WHICH ALL OUR REALITIES COULD CHANGE.

We're barreling headlong into 2016, and it's finally going to be the year virtual reality becomes an actual reality. First and foremost, the technology in the optics, screens and motion-tracking has advanced to the point where a great experience is now possible. But it's also important to note that the hardware in our PCs is getting to the point where more and more of us are going to be able to afford the ticket price of a VR-capable gaming rig. So, what are the main contenders for the VR crown?

OCULUS RIFT

We've got to start with the Facebook-owned Oculus Rift. It kickstarted the latest VR revolution, and with the Zuckerberg billions having been poured into the coffers, it means Oculus has been able to hold back its release to make sure it sparkles at launch next year.

We still don't have a final release date for the consumer version of the Rift, but we expect it in the first quarter of 2016. Final pricing is also quite elusive, but we've been told to expect something in the region of \$450-\$600.

The hardware is some of the most powerful being specced out right now. The screen tech is a Samsung OLED display with a resolution of 2,160 x 1,200, delivering 1,080 x 1,200 per eyeball. The refresh rate is important, too, at 90Hz, with a low-persistence screen to minimise blurring and avoid

it turning into your personal vomit comet.

The headset is only part of the experience, and Oculus has also unveiled new wireless controllers – the Oculus Touch, sold separately. They have crescent moon-style motion tracking around the hand, an analogue trigger and stick, as well as a pair of buttons. Oculus has released the minimum specs for your VR rig too – a GTX 970 or AMD 290, with at least a Haswell i5 CPU, and 8GB or more of RAM.

HTC VIVE

The contender to the crown is HTC's Vive VR system. Or should that be SteamVR? Developed in partnership with Valve, Vive is the name of the developer edition, so Valve could claim the SteamVR nomenclature at launch. Which is said to be around April 2016. There were initially rumors of a late-2015 launch, but the main thrust of SteamVR will likely be throughout 2016.

The specs are very similar to the Rift – with a 2,160 x 1,200 display resolution, and 90Hz refresh rate. The difference is it's meant to be used in a standing position, with 70 sensors (accelerometer, gyroscope and so on) in the headset. Wireless cameras will deliver a play area of 15 x 15 feet.

Its controllers look like a Steam Controller cut in two, with each having a trackpad under the thumb, a trigger, and a few buttons. There's also a hat

with a raft of sensors to keep tabs on top.

SteamVR is likely to have similar PC demands as the Rift, as it needs to drive that resolution at smooth enough frame rates to maintain fluid motion in your virtual world.

MICROSOFT HOLOLENS

Standing an outside chance of arriving in 2016 is Microsoft's HoloLens. It's more augmented than virtual reality, with the visor being see-through, but allowing a digital overlay to be dropped on to the surface in your field of view.

That field of view is limited, not stretching to the edges of your vision, but it allows you to "project" images in front of you. Microsoft demoed the device throughout 2015, with Halo and Minecraft, and is going to start shipping developer versions at the start of 2016. The price? A cool US\$3,000. Ouch.

Consumer versions are said to be in the "Windows 10 timeframe", though, which could mean well outside 2016.

It's the only wireless device of the three, needing no tethering, and potentially with wireless charging, too. It's also the only one to let you wear glasses. No official specs have been given, but the rumours have it running at 1080p, with potentially a next-gen Intel Atom processor at its heart.



The Rift comes with an Xbox One pad, but the wireless controllers are another step in immersion.



The current HTC Vive/SteamVR is more bulky than the Rift, but is more designed for physical movement.

ENTHUSIASM FOR SKYLAKE, TAKE TWO

INTEL HAS PLANS FOR ENTHUSIAST-CLASS COMPONENTS.

There's a good chance Intel has multiple options lined up, and much will depend on how AMD's new Zen CPU turns out. However, we still have certain expectations for Intel in terms of silicon sorcery. For starters, there will likely be a double whammy of high-end chips for its high-end desktop platform in 2016.

These chips are the "E" variants of the double-stacked Broadwell and Skylake architectures. We say "double-stacked" because of the close proximity of their launches in mainstream desktop format – the Core iX-5000 and 6000 series processors. In other words, just as mainstream Broadwell and Skylake CPUs arrived in quick succession in 2015, Broadwell-E and Skylake-E are both due in 2016. Precise timing isn't set in stone, but expect Broadwell-E in spring, with Skylake-E rocking up come autumn.

Specs-wise, Broadwell-E looks familiar, with a mix of six- and eight-core models for the existing LGA2011v3 socket. All indications are also that Broadwell-E will be compatible with existing Intel X99 motherboards.

The shape of Skylake-E is harder to predict, but it will likely require a new socket and a new chipset. Dare we hope for more than eight cores in Skylake-E? It's certainly possible, given Skylake-E Xeon chips for servers will get as many as 28 cores.

However, where the 2016 story for Intel gets complicated is 10nm chip technology. Intel was planning to roll out its new 10nm Cannonlake chips in 2016. Problem is, 10nm won't be ready until 2017. That's a problem for Intel's "Tick-Tock" chip launches, which see new CPU designs and new production processes rolled out in alternate years.

Intel's solution is an interim chip family known as Kaby Lake. It's best thought of as a refresh of Skylake than a properly new CPU family. At this stage, little to nothing is known about Kaby Lake's specifications or performance. In any case, unless AMD does something seriously exotic with its Zen CPUs, those Kaby Lake chips probably won't be available on the desktop until the very beginning of 2017.

So with Intel having difficulty ramping its 14nm processors and the 10nm node delayed, is Moore's Law – which states that computer chips double in complexity or halve in cost every couple of years – dead? The simple answer is yes. Progress will continue, but at a slower pace. Instead, some new paradigm is needed, be that quantum computing, or some other fundamentally new technology.

MEDIATING ON THE FUTURE

A DEFINING MOMENT FOR AMD'S PROCESSOR ARM.

AMD's Zen might be the most important thing to happen to PCs in 2016. It's the company's long-awaited new CPU architecture – designed to turn things around not just for AMD, but for everyone who loves PCs. Even Intel. The problem with AMD's processors being off-pace is that it has let Intel off the hook. Which is possibly why even Intel's CPUs have only seen subtle improvements.

Funnily enough, the most promising aspect of Zen isn't some hitherto unheard of special technological sauce or even the chip itself. It's the guy who was in charge of designing it. Jim Keller helmed development of the AMD Hammer architecture, also known as the original Athlon 64, and the last AMD chip that really took the fight to Intel. Keller had left AMD post-Athlon 64, and spent several years at Apple, developing the A4 and A5 chips for iPhones and iPads. He is one of the best in the business.

As for what we know about Zen, the technical details are few and far between. But it's an all-new CPU core, that much is clear. AMD has also said that Zen is a performance PC architecture – not a jazzed-up mobile chip. It's designed to do heavy computational lifting. What's more,

AMD has prioritised Zen over other projects, including plans for ARM-based K12 chips. The message is clear: AMD is serious about high-performance x86 chips for desktop.

AMD is ditching everything that went into its bold Bulldozer design that debuted in 2011. In other words, the modular design that sees integer units sharing floating-point resources is a goner. In its place, AMD has cooked up a more conventional approach, involving big, powerful cores. The priority, AMD says, is improving IPC, or instructions processed per clock cycle. AMD says IPC will be up by around 40% over its existing CPUs.

Zen will also introduce symmetric multithreading – the ability for a single core to process two software threads in parallel. So that's a big, fat core with multithreading support. Yup, it sounds exactly like a current Intel CPU core. Rumour has it the first Zens will have up to eight cores.

Zen will also see AMD CPUs produced on a much more modern FinFET silicon production process – probably GlobalFoundries's new 14nm process. An improved process should help dramatically with everything from clock speeds to power consumption. Zen will go into a new socket known as AM4, and will also support DDR4 memory.



"ZEN"

- ▲ Totally New High-performance Core Design
- ▲ Simultaneous Multithreading (SMT) for High Throughput
- ▲ New High-Bandwidth, Low Latency Cache System
- ▲ Energy-efficient FinFET Design Scales from Client to Enterprise-class Products
- ▲ Availability in 2016

AMD's prodigal son, otherwise known as Zen.

GRAPHICS CARDS

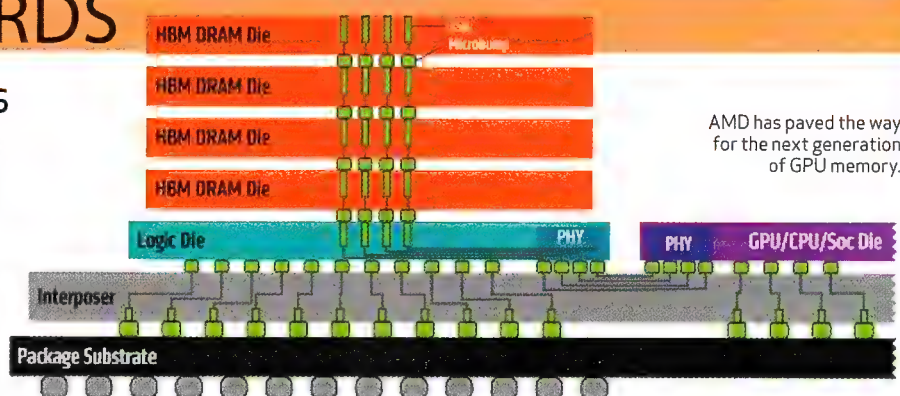
RENDERING BRAVE NEW WORLDS

Every year inevitably brings a lot of new and exciting technologies, and there's always plenty of anticipation. For the graphics industry, however, the hype may actually fall short of the technological advances, with 2016 shaping up to be a banner year.

GPU vendors have been stuck with 28nm process technology since early 2012. Briefly, 20nm focused on low-power designs for smartphones and tablets, but high-performance 20nm never materialised for GPUs. The next node from TSMC will be 16nm FinFET, representing more than a typical process shrink, and the addition of FinFET should further improve performance and clock speed.

With the large jump in manufacturing processes, a jump in transistor counts is expected. Nvidia is at 8 billion with GM200, while AMD uses 8.9 billion in Fiji, so it's possible – and rumours suggest it's likely – that the fastest chips will double the number of transistors. Which may make AMD's announced-but-not-yet-released dual-Fury card a bust. Why buy a dual-GPU card if you can get a single GPU with better performance and lower power requirements?

Both AMD and Nvidia are slated to move to new process technology, Nvidia with its Pascal architecture (GP104, GP106, etc.) and AMD with Arctic Islands (Greenland, Baffin, and Ellesmere). The competition might even result in a full-blown top-to-bottom launch of new GPUs. Little is known about the architectural details of either company, but even a simple die shrink and scaling to more graphics cores would yield a massive increase in



AMD has paved the way for the next generation of GPU memory.

performance, and there will be architectural enhancements as well.

In 2015, AMD released the first HBM (High-Bandwidth Memory) GPU with Fiji, packing 4GB of HBM and delivering 512GB/s of bandwidth. HBM 2.0 looks to double the bus width and quadruple the max amount of RAM per stack, meaning 16GB of HBM 2.0 with a full 1TB/s of bandwidth is possible. 16GB seems overkill, however, and it should be possible to still provide 1TB/s with only 8GB of HBM 2.0.

The problem with HBM is that it requires a silicon interposer to interface with the HBM dies, making it more expensive. There's a reason AMD's Fiji is the only HBM 1.0 GPU to date; it starts at US\$550, and was originally rumoured to target the US\$1,000 price point. HBM is a great fit for ultra-high-end GPUs, but what about the mere high-end GPUs in the US\$300 range? GDDR5 has been used for many years now, and it will likely continue to see use for years to come, but Micron has detailed the next iteration of GDDR: GDDR5X.

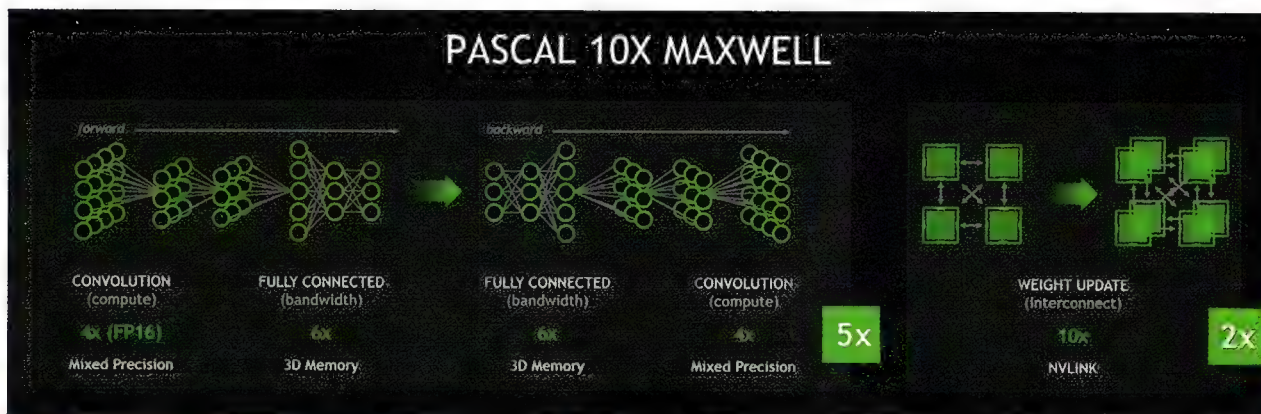
DDR stands for "Double Data Rate," using both the rising and falling clock edges for data transfers. Over the years, the amount of data fetched per cycle has increased. GDDR5X doubles

the pre-fetch to 16 words, or 64 bytes, doubling the bandwidth potential. The benefit of GDDR5X over HBM is that it can be used with lower-tier designs. If a manufacturer wants to build an inexpensive US\$100–\$200 GPU with 2GB RAM, HBM is almost out of the question. GPUs with DDR3 have been hanging around almost purely for cost considerations, but with GDDR5X on the horizon, hopefully we'll see less use of DDR3, and move to GDDR5 at a minimum, with GDDR5X occupying the middle tier.

The hardware isn't the only thing changing. DirectX 12 is out now, but we're still waiting on the games. Several are slated to launch during the 2015 holiday season, but some of these will slip into 2016. Heavy hitters include *Deus Ex: Mankind Divided*, *Fable Legends*, *Far Cry Primal*, *Ashes of the Singularity*, *Star Citizen*, *Hitman* and more. OpenGL has a similar low-level API called Vulkan, which builds on AMD's Mantle API. Little has been said of any official Vulkan titles, but unlike DirectX, Vulkan provides the possibility of cross-platform support, so Linux users aren't left out.

2016 could be the biggest inflection point in the graphics industry since the invention of the GPU in 1999. Bring it on!

PASCAL 10X MAXWELL



Nvidia's promising some incredible performance figures with the new 16nm process.

This mighty memory solution might be the key to all our storage woes.

WHAT IS 3D XPOINT™?

Crosspoint Structure

Selectors allow dense packing and individual access to bits.

Scalable

Memory layers can be stacked in a 3D manner



Breakthrough Material Advances

Compatible switch and memory cell materials

High Performance

Cell and array architecture that can switch states 1000x faster than NAND

WHERE NEXT FOR SSDS?

A NEW KIND OF STORAGE COULD CHANGE EVERYTHING.

Remember when the first mainstream solid-state drives popped up in 2008, and completely blew away traditional magnetic hard drives? Something similar looks to be on the cards for 2016.

That's right — there's a performance bomb heading the way of SSDs that could make existing drives look as outmoded as a magnetic hard drive. The big news is a new memory technology being jointly developed by Micron and Intel. Known as 3D Xpoint, it's not a souped-up version of an existing technology, such as RAM or NAND memory. It's completely new.

For starters, 3D Xpoint is claimed to be up to 1,000 times faster, 10 times denser and 1,000 times more robust than existing flash memory. Needless to say, these are staggering numbers, and even Micron and Intel wouldn't claim they apply across the board. Indeed, when Intel demoed 3D Xpoint at IDF, the result was seven times faster IOPS performance than the conventional flash memory comparison drive. Still very impressive, but not quite 1,000 times faster.

As for how 3D Xpoint works, it's completely different from flash memory. Instead of having memory cells composed of gates in which electrons are trapped, 3D Xpoint is a resistance-based technology. Each cell stores its bit of data by changing the conductive resistance of the cell material. This also means that each cell does not require a transistor, which makes for smaller cells and higher

density. Meanwhile, the "3D" part of the name hints at the stacked or multi-layer aspect of 3D Xpoint. Early chips only have two layers, but further layers will be added as the technology matures.

One final kicker for 3D Xpoint is the fact that memory cells are addressable at the individual bit level. That's a dramatic change from NAND memory, where whole blocks of memory — typically 16KB — have to be programmed to save just one bit of data.

The upshot for NAND is all kinds of read-modify-write shenanigans, and the need for complex garbage collection algorithms. That's all gone with 3D Xpoint. If that sounds wonderful, and it does, it's also worth bearing in mind that 3D Xpoint is so new and different, you can't just hook it into an existing SSD chipset and get going. All-new controllers and interfaces will be required. However, Intel has said it is prepping a new line of SSDs based on 3D Xpoint and known as Optane, and they are due out in 2016.

Where things get a little confusing is that it's not entirely clear where Intel and Micron see it sitting in the system. Some of their messaging has hinted at a new role that straddles system memory and mass storage, rather than replacing either. Likewise, Intel has said it is developing Optane-based memory DIMMs for Xeon server systems.

However you slice it, then, 3D Xpoint looks set to revolutionise storage performance in the PC, and it starts in 2016. What we don't know is how it fits in with the other big change going on in

storage, namely PCI Express-based storage interfaces and the new SSD-friendly NVMe control protocol. At this stage, frankly, it's anyone's guess. But what we can say is that PCI Express and NVMe have come just in time. The idea of running 3D Xpoint over a crusty old SATA connection, limited to just 500-odd MB/s, when 3D Xpoint drives are likely to be capable of 5GB/s and beyond, is quite comical.

Next up on the storage list is likely wider adoption of those PCI Express interfaces in 2016. M.2 has already become a standard feature on a lot of motherboards. Thing is, M.2 is a somewhat fragile and fiddly format, based as it is on exposed circuit boards that plug into slots. Often, these are flush to the motherboard, which makes support for more M.2 drives tricky. They can be mounted vertically, but that makes for a somewhat fragile solution.

Instead, what's needed is a PCI Express storage interface for external drives. A little like SATA Express, but something the industry actually gets behind. Happily, such an interface has arrived, and it's called SF-8639. At least, it used to be called SF-8639, until somebody realised what an awful name that was and rebranded it U.2, to sit nicely next to M.2. Anyway, U.2 is the new standard for 2.5-inch drives connected via a cable, just like SATA drives, and it has all the PCI Express goodness of M.2.

Look out for it in 2016.

POWERFUL, PORTABLE, STREAMABLE

WILL THE FUTURE OF GAMING BE MOBILE?

At the end of 2015, Nvidia announced the launch of the first full-fledged laptop graphics processor. A select range of signature gaming laptops from the likes of ASUS, MSI and Aorus, for the first time provided consumers with a fully unlocked GTX 980 GPU, featuring the same 2,048 CUDA cores, the same 256-bit memory bus, and the same 3GB of GDDR5 that the iconic desktop behemoth has to its name. To put that into context, whenever a discrete mobile GPU is created, it's essentially a stripped-back version of its desktop counterpart. However, unlike the GTX 980 Ti, which is technically a scaled-down version of the Titan X, these cores are often one step lower than their PC tower cousins. For example, a GTX 960 features a total of 1,024 CUDA cores, while its mobile equivalent only has a total of 640. It's this dramatic reduction in both power requirements and total heat output that helps ensure the GPU can run cool under pressure, without the need for a full-blown cooling system. Companies such as MSI and Alienware have made docking stations before, incorporating full-sized desktop GPUs, but they never had the same level of portability that a standard laptop had.

For a long time, laptop users have been getting a pretty bum deal when it comes to graphical processing power. And with Pascal right around the corner, and Nvidia already taunting us with scarily high specs for its new GP104 and GP100 graphics processors, it's only a matter of time before we see these full-fledged cores make more of a mark in the mobile market. This is thanks in part to the reduced power requirements of the 14/16nm FinFETs that Pascal will be utilising, on top of

the additional performance. Perhaps next year, we'll see Nvidia's first iteration of full-on GTX 1060s, -70s and above inside gaming notebooks and ultrabooks, finally calling an end to the M line of graphics processors we've all come to despise trying to identify in these reviews.

As far as overall general processing power goes, Skylake will no doubt continue to dominate the market. Rumour has it that Intel will be launching a grand total of eight separate mobile processors during the first half of 2016. The high end will feature two i7s, two i5s and two i3 CPUs, while the more entry-level notebooks will benefit from one Pentium and one Celeron processor. Taking a rather interesting step back, Intel has opted for all of them to operate on two cores, with hyperthreading enabled for a total of four threads, except the Celeron, aimed at the very budget end of computing.

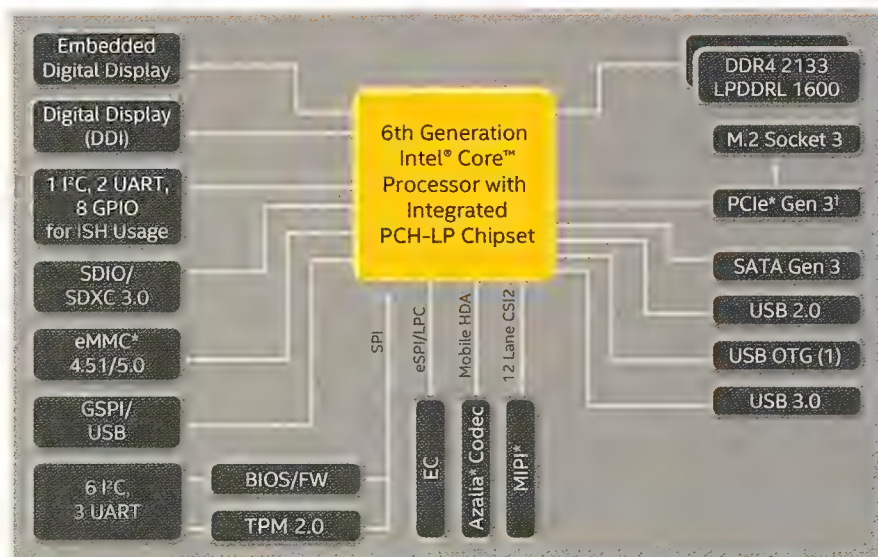
This is an interesting step back, as traditionally the top end of Intel's i7 mobile processors featured four cores

and hyperthreading as well. All eight are set to operate around a 15W TDP. On top of that, you'll be guaranteed Intel's new HD500 series integrated graphics and DDR4 support. However, it's unlikely we'll see much of the new memory standard making its way into laptops just yet, as these mobile processors are still hanging on to DDR3L compatibility as well – much like its desktop cousins, a memory that has been the mainstay of laptops, thanks to its low energy requirements.

Of course, AMD will be cementing itself further into the office market with new fully dedicated SoC processors. With the announcement of the release of the new Merlin Falcon embedded processor, based on the Excavator architecture, it seems AMD is pushing for more industrial and commercial roles, such as communication and infrastructure. At the very least, this should provide the company with a solid and dependable revenue stream to keep developing its consumer line products going forward, with Zen launching some time in 2016.

"Rumour has it that Intel will be launching a grand total of eight separate mobile processors during the first half of 2016."

Hyperthreading
for all!



LIFE BEYOND 4K?

COMING TO A SCREEN NEAR YOU: EVEN MORE PIXELS!

2015 was one heck of a year for PC monitors. It was the year 4K went mainstream. Ditto high-refresh 120Hz-plus technology. And frame-synching cleverness from both Nvidia and AMD. Oh, and we saw interesting new super-wide 34-inch panels. And curved screens, to boot. All the while, prices for established favourites like 27-inch 1440p IPS panels kept on falling. Nice. 2016 probably won't be quite as varied, but there's still plenty to look forward to.

In terms of technical innovation, quantum dot technology is looking pretty hot. It's not an entirely new display technology, along the lines of something like the ever-promising but never-quite-arriving-in-PC-monitors OLED technology. Instead, it's a new enhancement for existing LCD panels. Or rather, it's an enhancement for the backlight that powers all such displays.

In simple terms – well, kind of simple at least – quantum dots are nanomaterials that convert light. Shine light on quantum dots and they absorb it, tweak it and then kick out it out again. They're also highly tunable.



The upshot is that you can use them to modify and much improve the quality of a cheap single-colour LED backlight, and make it as good as – or even better than – an expensive RGB backlight. And that means more accurate and more vivid colours.

Philips launched the first quantum dot PC display in 2015, and you can expect an arm of QD monitors in 2016. Elsewhere, well, you can expect even

more pixels. 4K is now affordable, 5K screens are available, and the pixel count is only going to go up. LG and other makers of LCD panels are tooling up for 8K displays. Yup, that's 7,680 x 4,320 pixels. Wow.

In fact, 8K HDTV sets are already available, and it's inevitable that PC monitors will follow suit. So 8K is odds-on for 2016. Just don't expect it to be cheap.

THE RISE OF THE STREAM MACHINES

2015 saw the launch of Nvidia's first venture into the living room, in the form of the Shield Android TV. Powered by Nvidia's own Tegra X1 processor, featuring a 256-core GPU and 3GB of RAM, it's by far the most powerful streaming device out there... Factor in its insanely low price point of just US\$200, coupled with 1080p 60fps gaming, and you've got yourself a powerful living room streaming platform, capable of taking on any console at a fraction of the cost. Although it still hasn't been officially released in Australia, sadly.

Nvidia's intention has been to bring the PC experience to those mobile gamers who are after something more, but are still unwilling to commit to the cost of either a console or a dedicated gaming PC. In 2016, we should see that 1080p 60fps expand up to 4K 60fps, currently in beta, again bandwidth permitting. The true test for the little box of joy will be whether it can decompress that data fast enough to provide a lag-free gaming experience.

On top of that, the launch of Steam

OS in November has provided some with a tangible exit from the Microsoft ecosystem, alongside an interesting new way of gaming. US companies such as Zotac and Alienware have brought out custom Steam boxes, with many case manufacturers also designing chassis specifically for the new style of systems. The idea is pretty simple: PC gaming in your living room. Either through a prebuilt system, such as

Alienware's Alpha Steam Machine, or through your own custom build.

If you're still not entirely taken by Steam OS, there is one other perk. With Steam's support and close links to Linux, it's inevitable that a far greater number of Steam games will also now start to come with Linux support. Meaning those living on the other side of the OS pond will finally be able to game alongside Windows users. ■

Syber Vapor, a Steam-branded machine.



howto

» QUICK TIPS

Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

WINDOWS

MYSTERIOUS FOLDER EATING DRIVE SPACE

Until now my Windows 7-powered Toshiba Satellite laptop has always served me very well. However, a recent scan of my drive space using Glary Utilities reveals that 65% of available space (75GB in total) is taken up by something called System Volume Information. What is it, and why has it gobbled up so much space? Finally, is there anything I can do to reduce this large figure?

Will Doe

The System Volume Information folder is where all your System Restore points are stored. Normally, it's configured to only take up 10-15% of available drive space, but it's technically possible to give it up to 100% (this is not recommended!), so the first thing to do is see what its current settings are. To do this, click the Start button, right-click Computer and choose Properties, then click System Protection in the left-hand pane. Under Protection settings, make sure your C drive is selected and click Configure. From here, you should see a Max Usage slider, which is probably set to 65% or higher. The good news is that you can instantly reclaim space by reducing the slider to 20% or even less. Once you click Apply, the oldest Restore points will be removed to leave you with plenty of free space.

Mayank Sharma

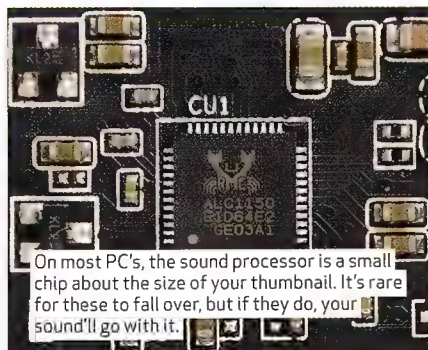
HARDWARE

I CAN'T HEAR YOU!

My faithful PC has suddenly lost all sound. I've checked the speakers and they're definitely fine. In Control Panel, it says "No Audio Device", but when I look in Device Manager, it lists Audio Codecs, Legacy Audio Drivers and MPU-401 Compatible MIDI Device, so there's obviously something there! I'm running Windows XP.

Stav Ioannou

It's equally obvious there's something missing. None of those things are the driver for your soundcard, which should be listed, even if you're using integrated sound on your motherboard. In Device Manager, you can click



Action > Scan for Hardware Changes to force it to redetect your hardware.

However, it may also be that your sound has gone because the sound controller has failed, in which case you should brace yourself for replacing the motherboard (or buying a replacement standalone sound card) as well. And while you're at it, you might as well upgrade to Windows 7 or 10. XP isn't officially supported, so it'll become more of a security risk as time goes by.

Luis Villazon

HARDWARE

THE 4K CONNECTION

I recently purchased an Acer 28-inch 4K monitor and am wondering what type of cable I should use to hook it up to my GPU. I seem to remember articles describing restrictions depending on whether I used DVI, HDMI or VGA. My videocard is a Gigabyte GeForce GTX 970 installed on an ASRock X79 Extreme4 motherboard with a

Core i7-4930K and 16GB of memory. I'm looking to purchase a second GTX 970 at some point in the future for SLI.

Roland Sauer

Good call on the second 970. One GTX 970 won't be fast enough for most games dialed up to their highest settings. A word of caution, though: a very limited number of today's titles need more than 4GB (all right, it's mostly just *Grand Theft Auto V* at this point). But you can see where the industry is headed, right? The fact that 512MB of the 970's 4GB on-board memory is much slower could affect performance in situations when the RAM runs out.

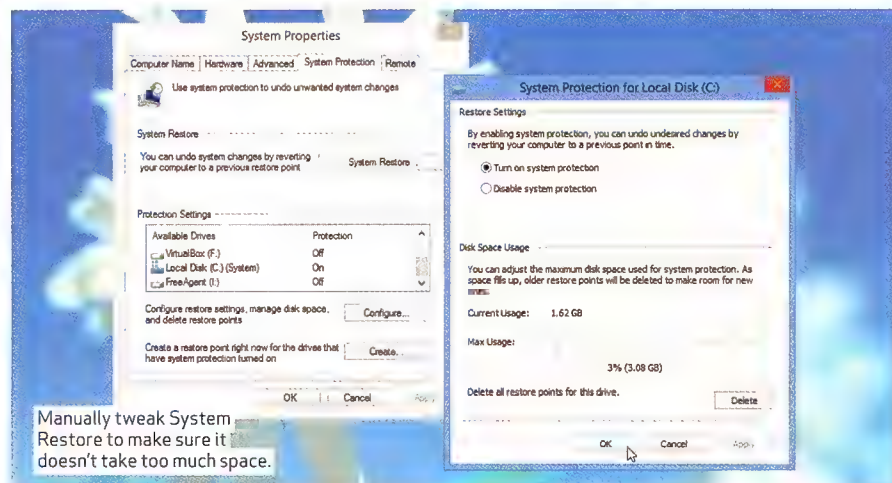
Enough alarmism, though. You asked about a monitor cable. Without question, use the screen's DisplayPort interface. There's a cable included in the retail package, so making the connection with your Gigabyte card should be easy. Going with DVI or HDMI instead will either result in a resolution lower than 3,840 x 2,160 or a refresh rate below 60Hz.

APC team

PROGRAMMING

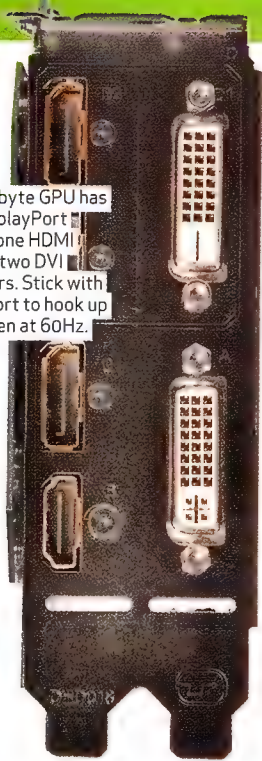
SOURCE CODE SHAME

I'm a postgraduate biologist working on population modelling in black squirrels. As part of my research, I've written some programs in various different languages that some of my colleagues have expressed interest in. I've always stalled



Manually tweak System Restore to make sure it doesn't take too much space.

This Gigabyte GPU has three DisplayPort outputs, one HDMI port, and two DVI connectors. Stick with DisplayPort to hook up a 4K screen at 60Hz.



them when they ask for my source code because the truth is I'm very embarrassed by it. It's very clunky and kludgy with no comments or documentation. I don't have the time to rewrite it all properly, but I can't let them see it like it is. Are there simple tricks or automated tools that will tidy up my code, and maybe make it easier to add comments?

Mark Devries

Anyone writing programs themselves writes kludgy code that is really hard for anyone else to read. The only people that write elegant, legible code are the ones that know it will be paraded in front of their peers, at the regular Tuesday morning code review session. If your code works, there's no reason you should feel embarrassed by it. If it doesn't, then all the more reason that colleagues should have a chance to spot the flaws, before you base your PhD on the results it generates. So don't waste time refactoring your code. You'll just introduce new bugs. Instead, release it using the Community Research and Academic Programming (CRAP) licence (matt.might.net/articles/

crapl). The terms of this licence explicitly indemnify you against "shame, embarrassment or ridicule for any hacks, kludges or leaps of faith found within the Program".

Luis Villazon

HARDWARE

WINNING THE LOTTERY

I'm new to PC building and have been trying to do my due diligence before tackling my first build. It'll mainly be for Adobe Premiere Pro, Photoshop and a bit of IC layout design. I've decided on an X99 motherboard (haven't picked the board yet; your recommendations are welcome), a Core i7-5820K, a GTX 980, 32GB of DDR4 memory, a 1,000W PSU and a water-cooling setup. This might be overkill, but I'd like a machine to last for three to five years without choking on Adobe's ever-increasing hardware requirements.

I keep hearing the term "silicon lottery". Is there any legitimacy to this expression? Could this variability be the result of installer error rather than manufacturing issues? I plan on using an anti-static wrist strap and mat like most people. But one other thing stuck out in my mind that I can relate to in my field of work. I'm a high-end Italian car mechanic, and I know from experience that, as an example, if you install a lightbulb with your bare hands, skin oils will get onto the glass and create a hot spot that will shorten the life of the bulb. The cure is to wear latex or nitrile gloves. Could this same phenomenon be affecting component installations? I also know that over 80% of engine failures or shortened life spans after a rebuild are due to a contaminated environment.

From what I've read, manufacturers use clean rooms, so the rate of failure people report with the silicon lottery seems suspicious.

Spencer

Winning the "silicon lottery" is less about defective or damaged components and more about finding that one CPU or graphics card that overclocks above and beyond any enthusiast's expectation. A processor

Latest: HOWTO: Get tenure
Next: 3 qualities of successful Ph.D. students
Prev: 3 shell scripts that can improve your writing
Random: Parsing with derivatives (Yace is dead: An update)

The CRAPL: An academic-strength open source license

[article index] [email me] [mattmight] [mattmight] [ras]

Academics rarely release code, but I hope a license can encourage them.

Generally, academic software is stapled together on a tight deadline; an expert user has to coerce it into running; and it's not pretty code. Academic code is about "proof of concept." These rough edges make academics reluctant to release their software. But, that doesn't mean they shouldn't.

Most open source licenses (1) require source and modifications to be shared with binaries, and (2) absolve authors of legal liability.

An open source license for academics has additional needs: (1) it should require that source and modifications used to validate scientific claims be released with those claims, and (2) more importantly, it should absolve authors of shame, embarrassment and ridicule for ugly code.

Openness should also hinge on publication: once a paper is accepted, the license should force the release of modifications. During peer review, the license should enable the confidential disclosure of modifications to peer reviewers. If the paper is rejected, the modifications should remain closed to protect the authors' right to privacy.

Toward these ends, I've drafted the CRAPL—the Community Research and Academic Programming License. The CRAPL is an open source "license" for academics that encourages code-sharing, regardless of how much how much Red Bull and coffee went into its production. (The text of the CRAPL is in the article body.)

To get things started, I've released all my research code under the CRAPL.

Why the CRAPL?

In academic software (my own included), software engineering principles vaporize as deadlines loom, and code becomes overrun with debugging hooks, perl golf, hard-coded configuration variables, dirty hacks, commentless tracts, a Gordian build system, and of course, no documentation.

It's not the kind of code one is proud of.

I think a lot of academics are embarrassed to release their code.

But, it doesn't matter. We should release our code, warts and all.

And, we should applaud people that do so.

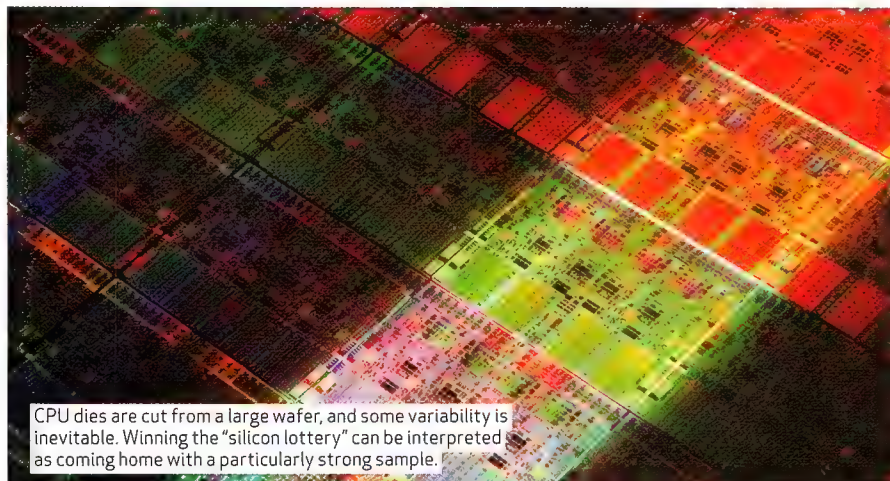
When it comes time to empirically evaluate new research with respect to someone else's prior work, even a rickety implementation of their work can save grad-student-months, or even grad-student-years, of time.

Embarrassed by how messy your code is? Just release your apps under the CRAP licence.

composed of hundreds of millions of transistors in a few hundred square millimeters of area is mind-bogglingly complex. There will always be some variability involved in the manufacturing process, and the companies selling those chips do an admirable job of sorting them out into actual products. You're only guaranteed the specifications on the box. On your Core i7-5820K, that's a base clock rate of 3.3GHz, and a maximum Turbo Boost frequency of 3.6GHz. Let's say a majority of 5820Ks make it to 4.5GHz with all six of their cores active. A special example might be stable at 4.7GHz under the same conditions. The owner of that processor would be said to have won the silicon lottery.

As far as the projected specs for your first build, that should be a well-balanced system. The GTX 980 might be considered overkill for the tasks you mentioned. However, the Doc assumes you'll do a little gaming, too. Oh, and he didn't see any mention of storage. Be sure to snag an SSD with enough space for your OS and those performance-sensitive apps inspiring this project!

APC team



CPU dies are cut from a large wafer, and some variability is inevitable. Winning the "silicon lottery" can be interpreted as coming home with a particularly strong sample.

Unlock Windows 10's God mode

Ian Evenden shows you how to rise to Windows godhood. Sort of.

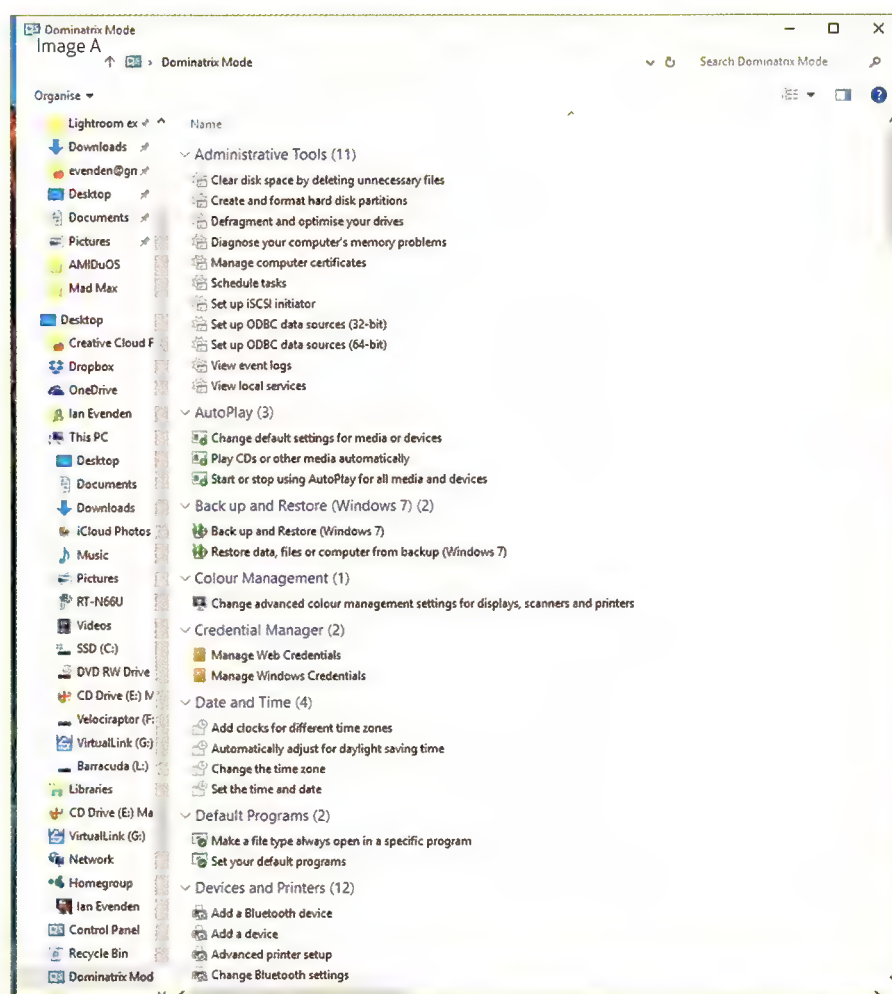
Anyone who's been using Windows 10 for a while will know the pain of trying to find a particular setting. Anything more involved than changing the screen wallpaper, or turning Wi-Fi on and off again, can be done in any of three places. And the Control Panel, despite its new stripped-back white minimalist

loveliness, isn't always completely helpful when it comes to pointing you toward the settings you need.

Wouldn't it be great, then, if you could gather all the settings together, like sheep in a pen? A single place where you could look for troublesome system settings or motherboard properties.

Well, you can.

Once you've created the God Mode folder, you'll find more than 200 entries for settings and preferences from across your PC. While Windows 10 streamlined the locations of its various settings, anyone still using Windows 8 will find this especially useful, because they still live under the tyranny of the Charms bar.



1 CREATE A GOD MODE FOLDER

Unfortunately, the code is a bit more complex than "IDDQD." Create a new folder (right-click and choose New > Folder), and name it "GodMode.{ED7BA470-8E54-465E-825C-

99712043E01C}." Find it online and copy and paste – it's easier – although the first word (or words, with spaces) before the period, which becomes the name of the folder, can be whatever you want [Image A]. "Dominion" maybe.

Or "Divine Right Of Kings". "Exploit The Tweak"? Whatever you choose, a folder with that name appears on your desktop. We've chosen "Dominatorix Mode" because we're children who still feel funny when we think about *Diablo II*'s Succubus.

2 OPEN THE FOLDER

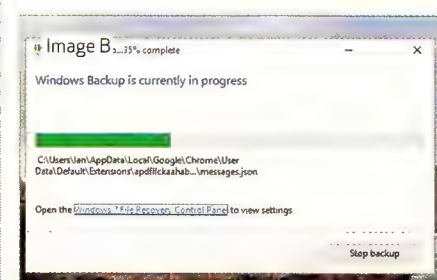
The folder's icon should change to that of the Control Panel. Double-click to open it, and you'll find something not dissimilar to the Control Panel – except there are many more options. Over 200, in fact.

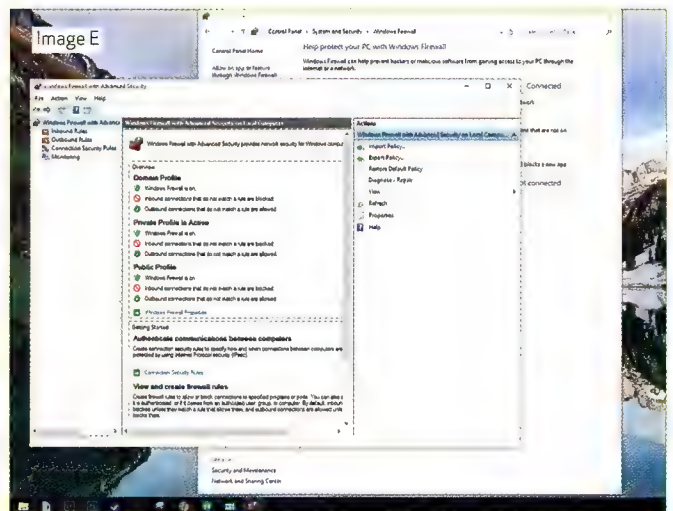
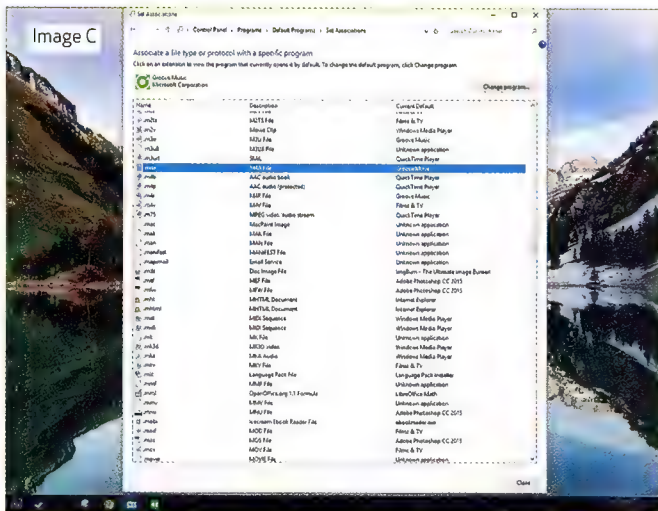
3 WHAT'S INSIDE?

There's nothing here that you won't find elsewhere, scattered across Windows' myriad settings and preference panes. The beauty of God Mode is that it gathers them in one place, so you don't have to go searching for the setting you need, or play the fun Control Panel Guessing Game about which category what you need will be found in. The folder is simply organised from A to Z, with a search box at the top.

4 ADMIN TOOLS

First up are the Admin tools, including defragging for improving the





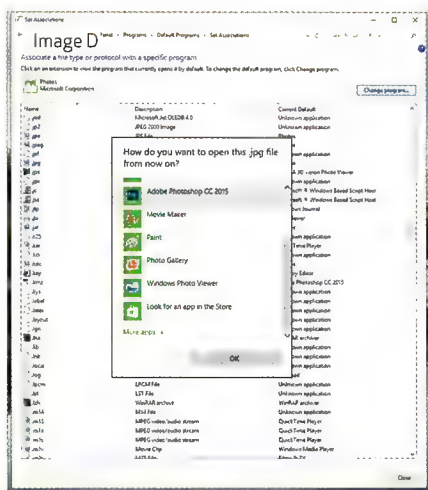
performance of cluttered non-SSD drives, the creation and formatting of drive partitions, and the Task Scheduler, for making your friend's PC play Acca Dacca at 3am.

5 AUTOPLAY

Slightly more interesting is the next section, Autoplay, which enables you to change settings that usually only appear when you plug a new removable drive into the PC. Double-click the first option, "Change default settings," and you can alter how your PC reacts to all kinds of removable media, including turning Autoplay off altogether if it's getting too much.

6 BACKUP

"B" is for "Backup" and that's the next item on the list. It may say Windows 7 after it, but this backup utility works in Windows 10, after its sad removal from Windows 8.1. Click it, pick a target drive with lots of free space, allow Windows to manage your backups, and... off it goes [Image B]. You can choose to manually select what is and isn't backed up if you like, but Windows does a pretty good job, and knows where all the important stuff is.



7 FILE DEFAULTS

Default programs are the ones that launch automatically when you double-click a file [Image C]. For a Word document, you may well want Word, but if you open a JPEG, would you prefer Photoshop rather than Windows Picture Viewer [Image D]? This is where you change it. Select the .jpg file extension from the enormous list, click the "Change Program" button at the top, and a list appears of programs Windows thinks may be able to open the file. Choose the program you want to use — if it's not on the list, click "More apps." Still not there? Click "Look for another app on this PC", which lets you browse to the app of your choice.

8 EASE OF ACCESS

Further down the list, past the arcane mysteries of Bluetooth and Printers (whatever they are), you'll find the Ease of Access Center for useful things like turning off animations if they give you motion sickness, or the on-screen keyboard for those times you only take a mouse to the couch to watch Netflix, and can't be bothered to get up again. The Internet Options are a little further on, so you can delete cookies, enable pop-up blocking, or clear those embarrassing Netflix movies from your history. *Breast Men* (1997) is a fine example of celluloid art, but perhaps not something you should admit to watching while you're around your mother.

9 MORE OPTIONS

Anyway, further down the list, past "Mouse Options" and something called a "modem", we find our old friend "Add and Remove Programs" — something the APC team is always having to use the Control Panel search to find. Remote access is just below it and below that is "Security and Maintenance", where you'll find actually important stuff, like user account controls and error reports.

Further on, there's text-to-speech and speech recognition settings, too, for those who like to think we're on the bridge of the *Enterprise*.

10 SYSTEM SETTINGS

Finally — well, almost finally — there's "System". From here, you can check your processor speed, tweak performance, fiddle with virtual memory and access the Task Manager to kill errant processes that won't close by any other means. Windows Defender and Windows Firewall live right at the bottom of the list [Image E], two things that are generally just switched on and left alone. You might need to access the firewall if you're messing with an app that needs internet access but isn't on Microsoft's list, however.

Microsoft's Customer Improvement Program

If privacy is important to you, you might want to opt out of Microsoft's Customer Improvement Program — it's under "Security and Maintenance" in the God Mode folder. This background process collects anonymous information about your PC as you work, and sends it to Microsoft. It does this with a scheduled task, which should run at a time you're not using your PC. Under Windows 7, however, it was noted that disabling it improved performance — so there's no reason to leave it running if you want to squeeze every drop of juice out of your current build. Or if you're feeling philanthropic, you could leave it on and help Microsoft improve the features of Windows, based on your usage. ■

Wrangle back control from Windows Update

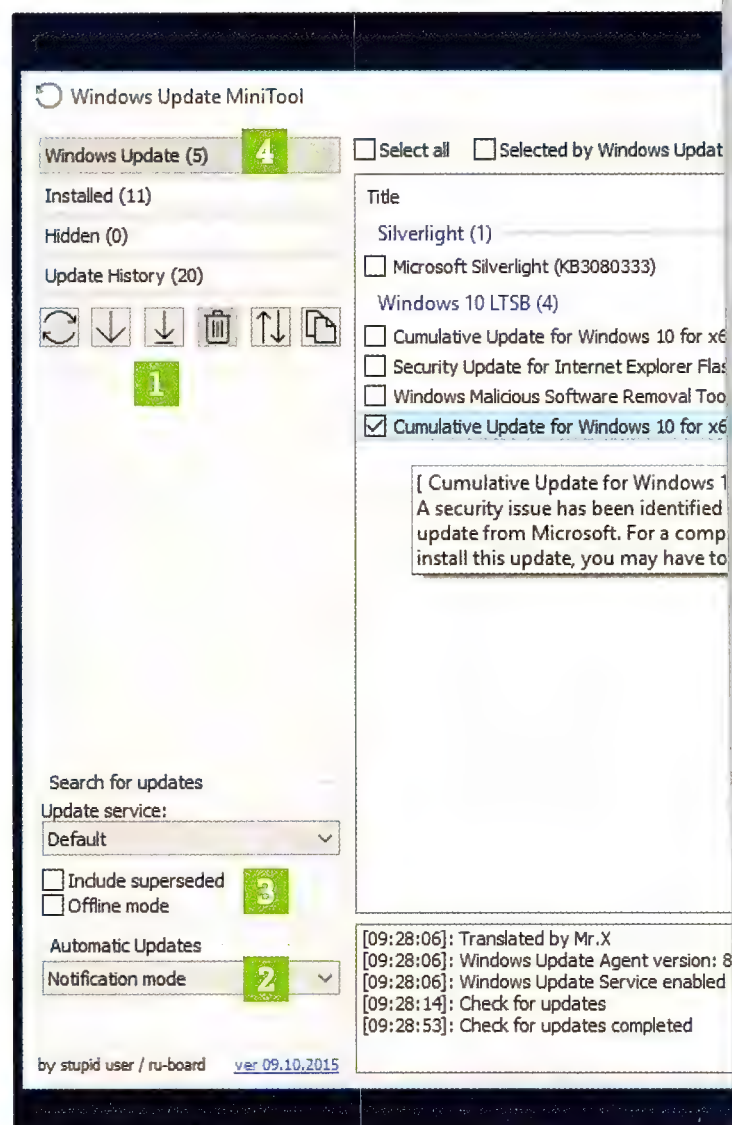
Discover how to tame the worst excesses of Windows 10's Windows Update and regain control of your PC with Nick Peers.

The new Windows Update mechanism in Windows 10 has been rigidly designed. While there's good reason to ensure critical security patches and fixes are installed automatically, some Windows 10 users have already suffered from Microsoft's over-zealous policy of forcing updates before those updates have been properly tested.

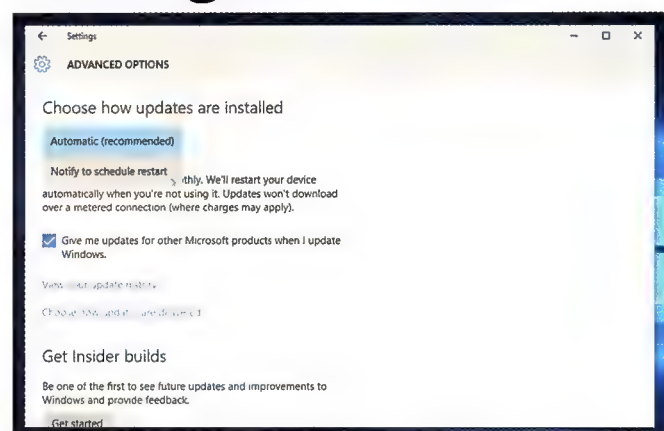
Thankfully, there are some ways in which you can regain control of how Windows Update operates — particularly if you're a Windows 10 Pro user.

But even if you're stuck with Windows 10 Home, where it's impossible to change the automatic setting, there are still tips, tricks and tools you can use to regain some control and make more from Windows Update.

In this tutorial, we'll reveal everything you need to put Windows Update back in its place.

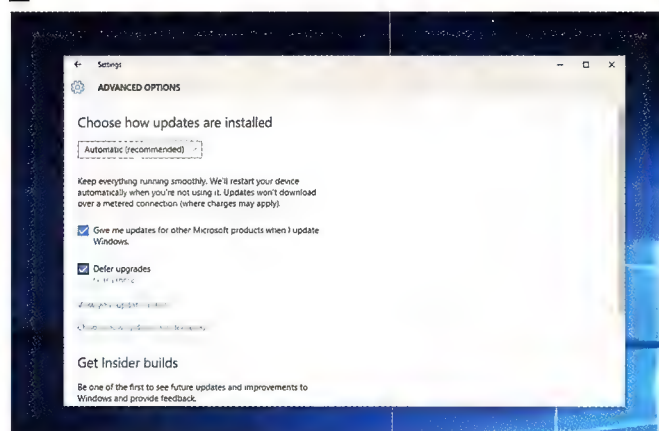


Configure Windows Update



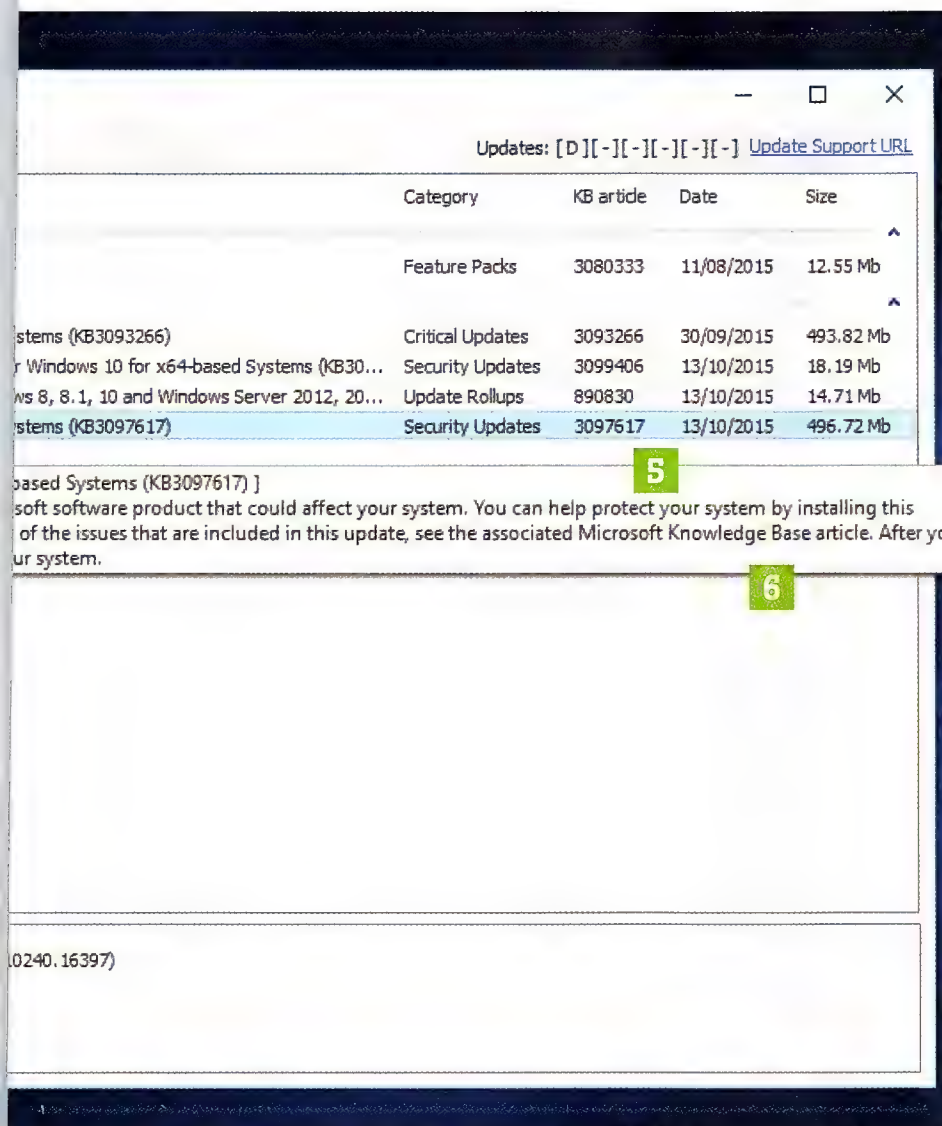
1 BASIC SETTINGS

Click Start > Settings > Update & Security > Windows Update to check for updates. Click "Advanced options" to change how updates are installed — if you select "Notify to schedule restart", you'll be prompted whenever updates have been downloaded and installed. You can also opt to receive updates for other Microsoft products like Office here — just tick the box.



2 DEFER UPDATES

Windows 10 Pro users can postpone non-essential updates, giving time for any bugs to be discovered and ironed out. Tick the "Defer upgrades" box to enable this — you'll effectively be switched to the "Current branch for Business", which means only essential security updates are installed immediately; others will be deferred until they've been more thoroughly tested (by Home users).



1 CONTROLS

These perform the following actions: check for updates, download only, install, remove, hide/unhide and copy to clipboard.

2 CONFIGURE UPDATES

Click here to tweak automatic updates in Windows 10 Pro after you've followed step six of the guide.

3 UPDATE REPOSITORY

Choose which update repository to search – in most cases, the Default choice is best.

4 SWITCH VIEW

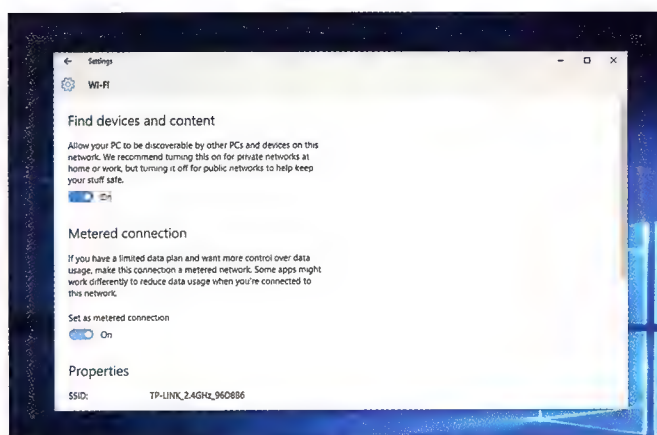
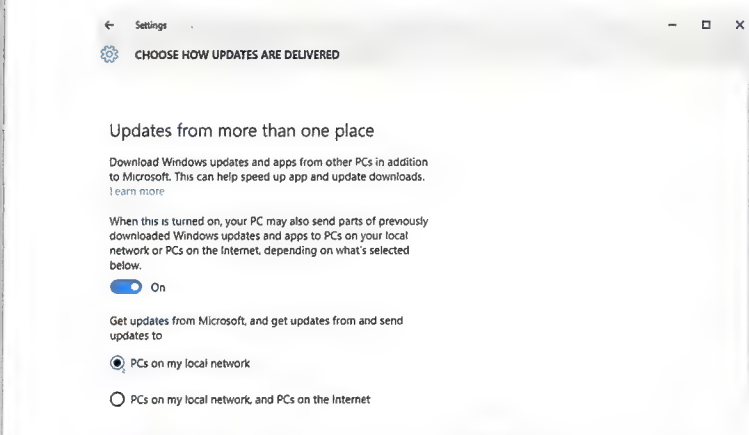
Click these buttons to move between viewing the available, installed and hidden updates, plus review your update history.

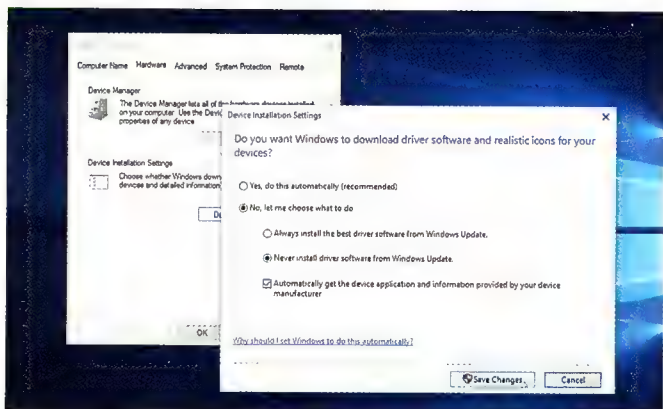
5 VIEW UPDATES

All applicable updates based on your viewing choice are displayed here. Tick the box next to each to select them.

6 MORE INFO

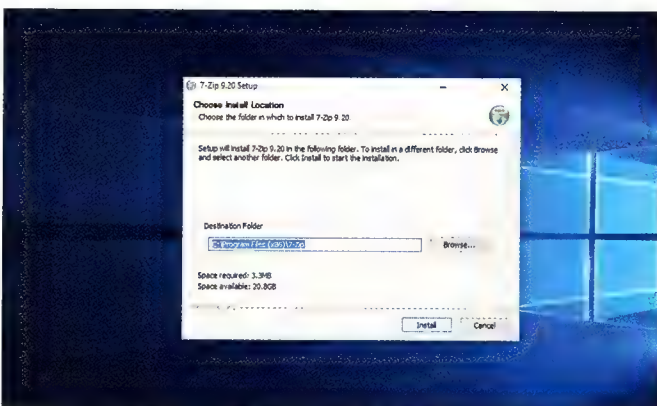
Roll the cursor over an update to reveal this pop-up providing a detailed description.





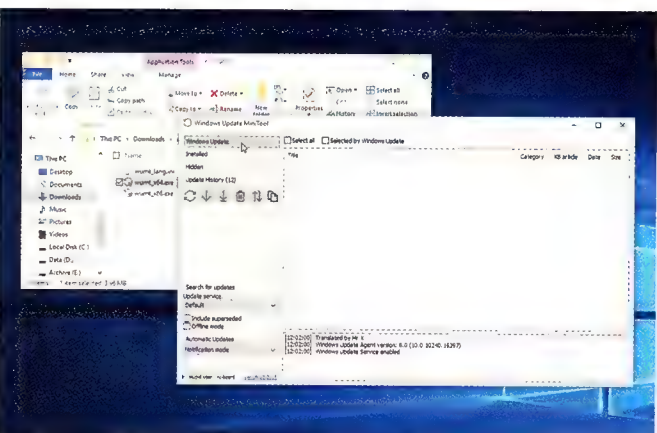
5 DISABLE AUTOMATIC DRIVER UPDATES

By default, Windows Update updates supported hardware devices too — if you'd prefer to manage this yourself, right-click the Start button and choose System. Click Advanced System Settings, switch to the Hardware tab and click Device Installation Settings. Select "No, let me choose what to do" followed by "Never install driver software" and click Save Changes.



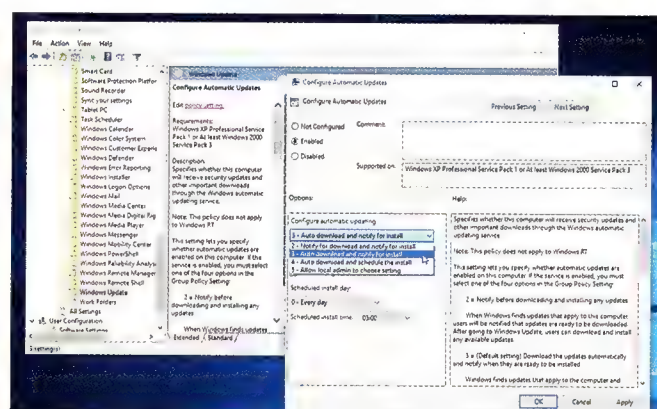
7 MANAGE UPDATES WITH MINITOOL

Windows Update MiniTool is a portable app that gives you more control over viewing, managing and hiding updates. It's delivered in a .7z file, which can be extracted using a free program called 7-Zip. Download and install it from www.7-zip.org. Once done, browse to <http://bit.ly/winupdmmini> and click the en_wumt.7z icon to save it to your Downloads folder.



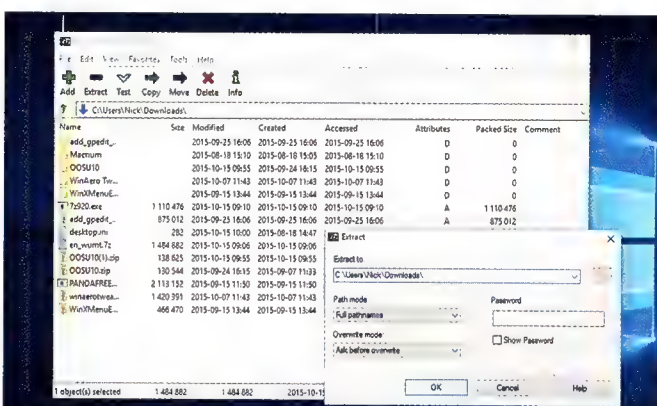
9 LAUNCH APP

Open the en_wumt folder and double-click wumt_x64.exe if you're running the 64-bit version of Windows, or wumt_x86.exe for the 32-bit version to launch the app. You'll see a two-paneled window appear with options on the left. Use the annotation on the previous page to help identify key parts of the program, then click the "Check for updates" button to review available updates.



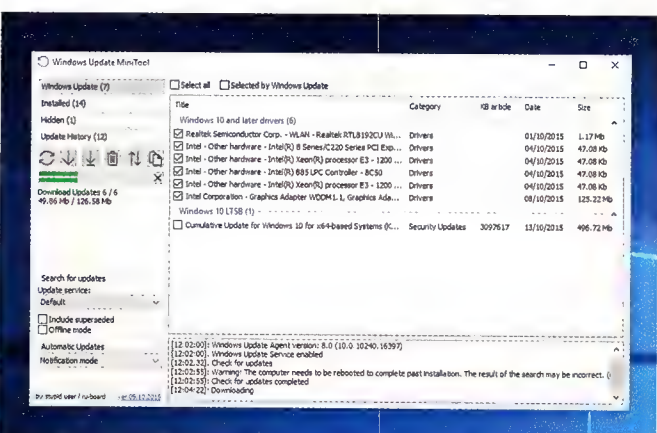
6 DISABLE AUTOMATIC UPDATES

Pro edition users should type "gpedit" into the Search box and click "Edit group policy". Expand Administrative Templates > Windows Components under Computer Configuration and select Windows Update. Click Configure Automatic Updates in the right-hand pane, select Enabled and then pick option 2 or 3 to force Windows to wait for your say so before installing updates.



8 EXTRACT AND RUN

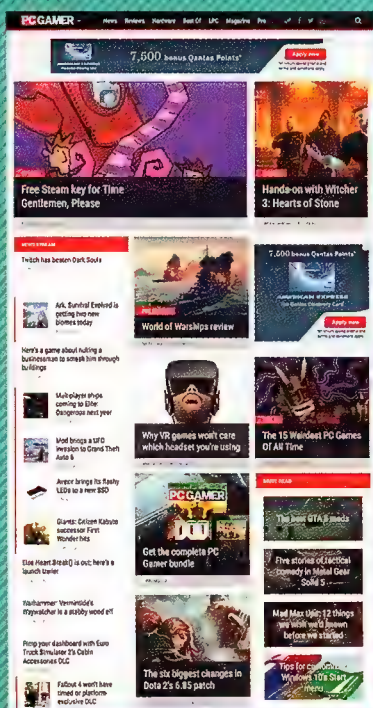
Open Z-File Manager from Start > All Apps > 7-Zip menu. Click Computer, then browse to your Downloads folder (typically C:\Users\<username>\Downloads), select en_wumt.7z and click Extract. Remove the trailing \en_wumt from the "Extract to:" box and click OK. Once the files have been extracted, close 7-Zip and navigate to your Downloads folder in File Explorer.



10 MANAGE AND TWEAK

Roll your mouse over an update for a more detailed description, or select it and click Update Support URL to see if a Knowledgebase article can provide more information. You can hide any unwanted non-critical updates from view. Download and install individual updates from here, plus review installed and hidden updates, plus your update history using the controls.

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Accessing Excel's custom lists via a macro

Helen Bradley explains how to make Excel's custom lists easier to discover.

Excel's Custom Lists tool lets you enter repetitive headings into a worksheet very quickly. It's easy to create custom lists of your own but a little more difficult to actually determine what lists are available to use. To make it easier to access your custom lists, we've designed a macro that shows you the available lists and enters the first value from the chosen list into the selected cell.

DESIGN THE MACRO

To create the solution, open the Visual Basic editor and choose Insert > UserForm. Add a label, a ComboBox and two CommandButtons to the form. Set the Label caption to "Available Custom Lists", CommandButton1's Caption to "Click to Enter the First List Item", CommandButton2's caption to "Quit", and the Form caption to "Select Custom List". Set the ComboBox ColumnCount property to "2" and CommandButton1's WordWrap property to "True".

Double click the Form and add this code:

```
Private Sub CommandButton1_
Click()
    userSelection = ActiveCell.
Address
```

```
Range(userSelection) =  
ComboBox1.Value  
Unload Me  
End Sub  
  
Private Sub CommandButton2_  
Click()  
Unload Me  
End Sub
```

```
Private Sub UserForm_
Initialize()
    Dim myarray() As String
    Dim myarraycount As Integer
    myarraycount = Application.
CustomListCount
    ReDim myarray(1 To
myarraycount, 0 To 1)
    For i = 1 To myarraycount
        firstitem = Application.
GetCustomListContents(i)
        myarray(i, 0) =
firstitem(LBound(firstitem, 1))
        myarray(i, 1) = "... " &
firstitem(UBound(firstitem, 1))
    Next i
    ComboBox1.List = myarray()
    ComboBox1.ListIndex = 0
End Sub
```

Choose Insert > Module and add this code into the module:

```
Sub listDisplay()  
UserForm1.Show  
End Sub
```

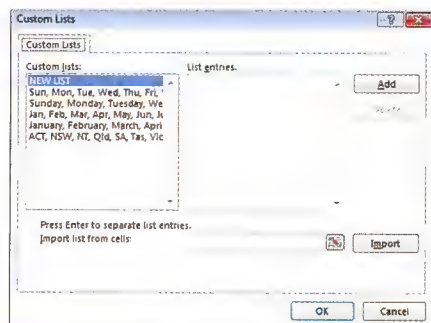
Save the file as an xlsx macro-enabled Excel file. Click in a cell and run the macro to test it. Select the desired custom list from the ComboBox and click to enter the first list item into the selected cell, or the active cell if you have multiple cells selected. You can then drag the fill handle to enter the remainder of the list items.

HOW IT WORKS

The code in the UserForm_Initialize event fills the ComboBox dynamically when the macro is run so it always includes all available custom lists. This is important for when custom lists may be added or deleted at any time.

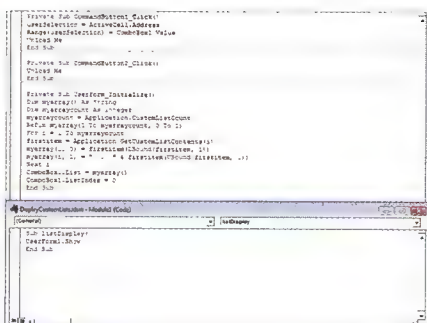
The code creates a two-dimensional array to store the first and last items in each custom list. A "for...next" loop works through all custom lists to fill the array. The array contents are then loaded into the ComboBox and the default value is set to the first list item. There are always at least four lists available as Excel ships with four custom lists to which you can add more if desired.

If you create this macro in your personal.xlsm file it can be used with any worksheet any time.



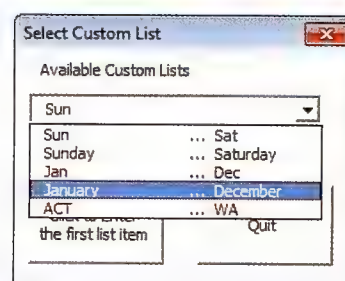
STEP 1

1 Excel custom lists are easy to create but it is not easy for inexperienced users to discover what is available.



STEP 2

 This is the code of the macro.



STEP 3

 **STEP 3** The macro displays a dialog from which you can select a custom list and then click to enter the first list item into the selected cell. 



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THE LAPTOP THAT CAN'T BE REPLACED BY A TABLET

Customise iOS Mail gestures

Change the gestures used by iOS Mail to help organise emails in a hurry.

Mail on iOS has been hugely improved over the last few years, and now includes a number of features that make it easier to manage the daily barrage of emails. One of the most useful is the ability to use gestures – a simple finger swipe either left or right across an email in the list for options to quickly delete it, mark it as

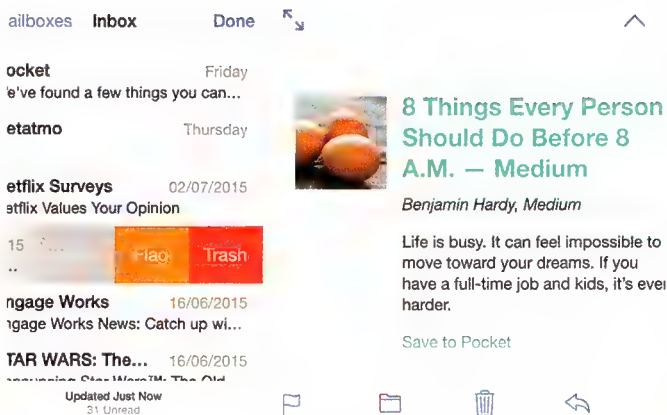
read or unread, or to perform a number of other tasks without even having to open or read the message.

Those two basic gestures work well for triaging new messages, and you have the ability to customise the actions they perform. (It's no surprise that Microsoft's excellent iOS version of Outlook includes similar gestures.) Your options are fairly limited, but you

can do things like switch around the actions (which is handy if you're left-handed), or archive emails rather than simply delete them.

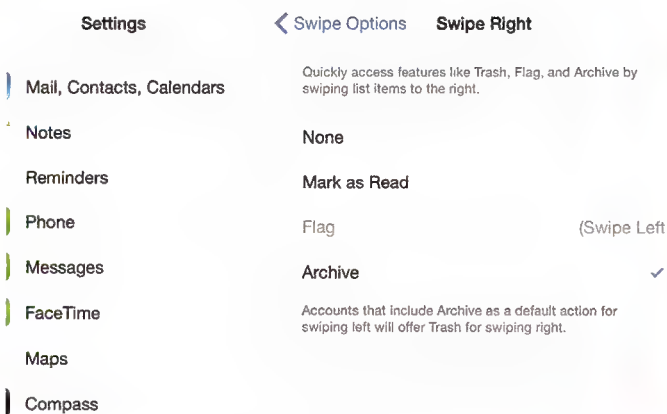
These customisation options are rather limited, but if you dig a little deeper into Mail's settings, you can make changes that will help you to organise your emails in the way that suits you best.

Customise gestures in iOS Mail



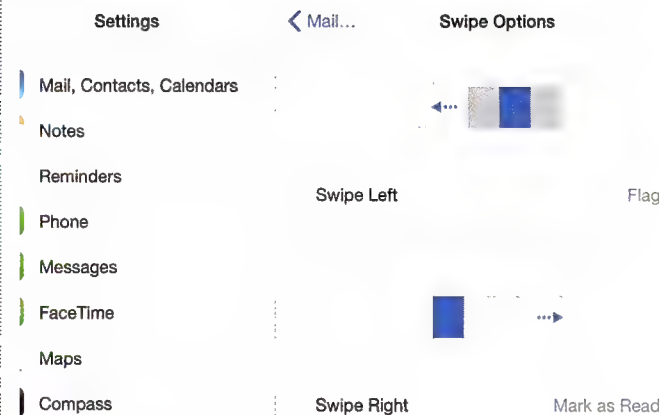
1 LEFT AND RIGHT SWIPES

You can swipe left to right across a message to mark it as read or unread. Swiping from right to left works slightly differently. A long swipe to the left immediately deletes the email, but by swiping a little more slowly, you'll see additional options, such as the ability to flag the email for reading later.



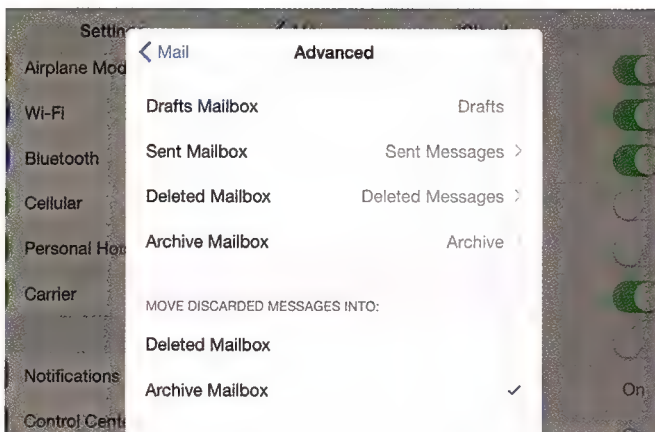
3 CUSTOMISING GESTURES

Your options are fairly limited. If you tap on Swipe Right, you can change it to either flag the email or file it in the Archive mailbox. If you're left-handed, you might want to change the Swipe Left gesture to Mark as Read so that the default actions are now reversed. But we're not finished yet.



2 SWIPE AWAY

You can change the way the gestures work in the Settings app > Mail, Contacts, Calendars > Swipe Options. The diagrams here show the currently assigned actions. Only the actions in the positions shown in blue are changeable. They are set to Flag and Mark as Read by default.



4 MAIL BEHAVIOURS

In Settings > Mail, Contacts, Calendars, tap your iCloud account at the top, then Mail under the Advanced heading. Scroll down and tap Advanced to control which mailboxes are used. You could specify that discarding an email (a left swipe) puts it in the Archive mailbox rather than Deleted. ■



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Print instantly on OS X

Matthew JC. Powell has some power tips for hard-copy lovers.

One day, we will have paperless offices. One day, we will never need to print a document and hand it to someone for a signature or — ugh — mail it like cave people. Until that day arrives, we still have and need printers.

Printing is easy, of course. In any Mac application, you have to merely select Print from the File menu or even hit Command-P, and your document will emerge more or less as it should.

But what if you're not in an application? What if you just want to print a document, and you don't even necessarily know what application created it?

WELL, THAT'S EASY

If you select a file in the Finder and then go to the Finder's File > Print command (or press Command-P), the file's default application (or whatever application you have on your computer that is set to open that kind of file, if you didn't create it) will open and print the application. Pretty nifty.

BUT IT GETS NIFTIER

Open System Preferences and select the Printers & Scanners pane. You should see your printer (or printers) listed in the left-hand column with small icons. Grab the icon for the printer you want to use and drag it to the Desktop. The icon will appear with a small arrow next to it, indicating it is an alias. Actually, it's a specific type of alias called a proxy.

To print a file, simply drag it and drop it onto this proxy. Without even opening up an application, the Mac will attempt to print the file. Presuming you have an application installed that can handle the file, the Mac will take advantage of the application's printing resources without opening it.

If you want to view the print queue to pause or delete jobs, just double-click on the proxy. You can also drag the

proxy to the Dock to save clutter on the Desktop if you wish.

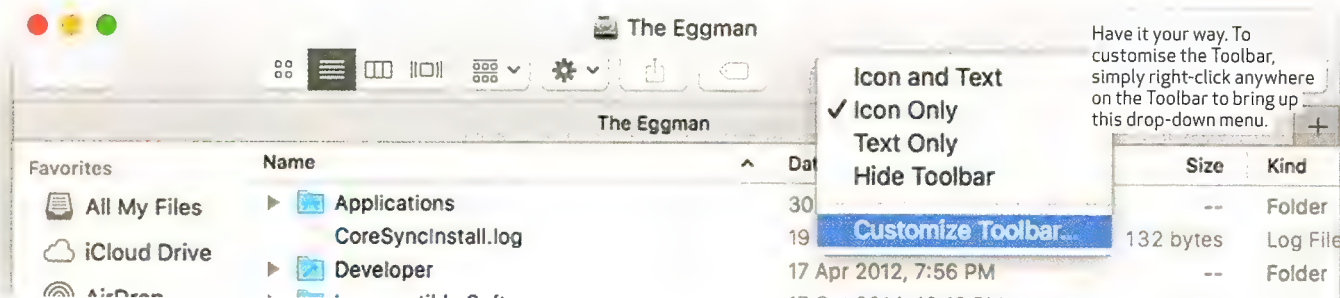
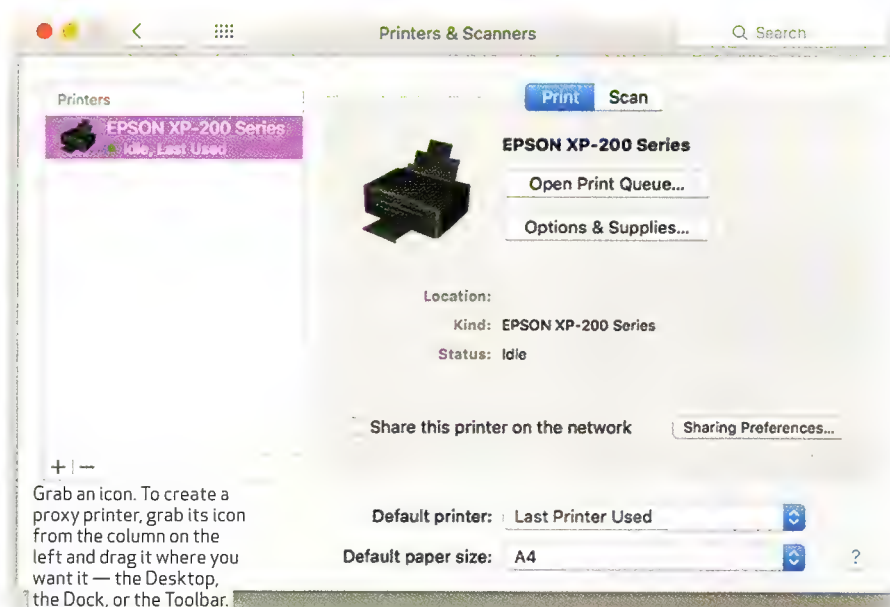
This kind of desktop printing was possible in the later versions of Classic Mac OS as well, but for whatever reason, it's been largely forgotten in the OS X era. A pity, because it's a great timesaver.

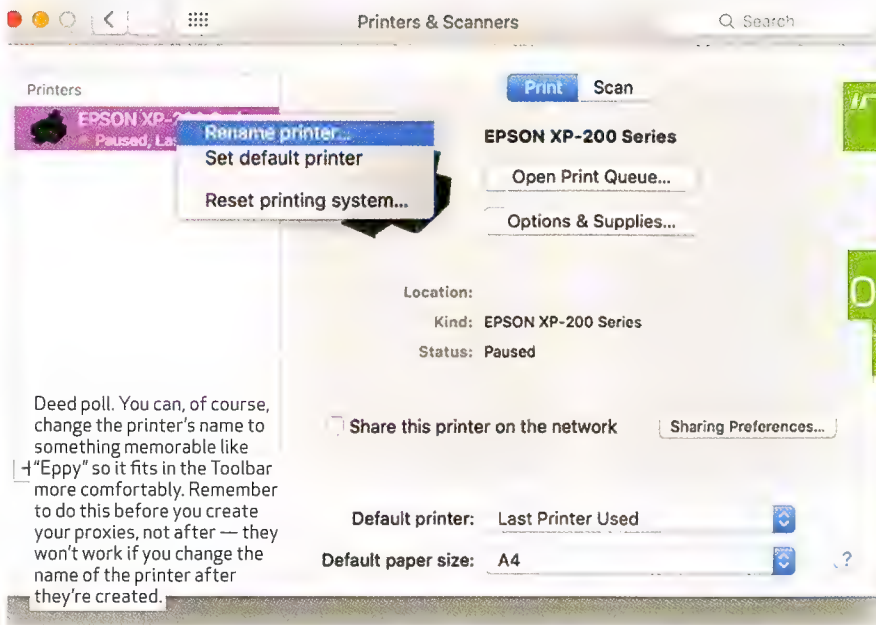
But wait there's more. There is in fact another way to print instantly within OS X — one that you couldn't do in Classic Mac OS — and this one's even niftier.

Open up a Finder window — any Finder window — by double-clicking on your hard drive icon or whatever. Then right-click in the Toolbar at the top of



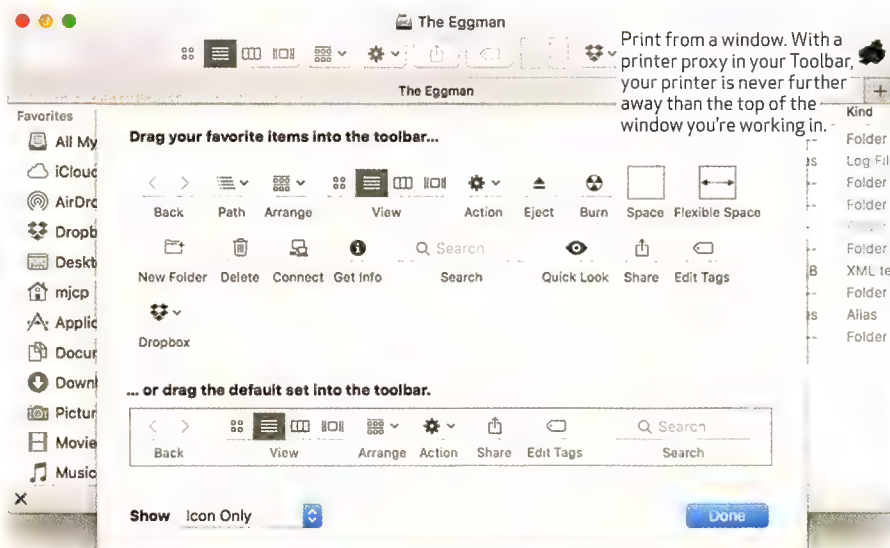
"It's actually well worth poking around in, as the Toolbar can become quite powerful when you've bent it to your will."



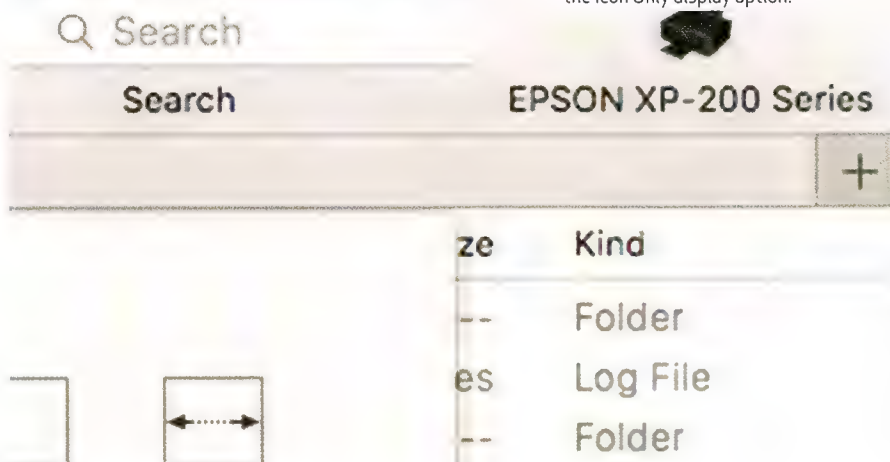


Deed poll. You can, of course, change the printer's name to something memorable like "Eppy" so it fits in the Toolbar more comfortably. Remember to do this before you create your proxies, not after — they won't work if you change the name of the printer after they're created.

"To print a file, simply drag it and drop it onto this proxy. Without even opening up an application, the Mac will attempt to print the file."



How do you spell that? Printer names can be unwieldy, so if you leave their default names it's advisable to use the Icon Only display option.



the window — the part where Search bar and navigation buttons are. You should see a drop-down menu, one option on which is 'Customize Toolbar...' Click on that, and you'll see a range of options for tools that you can drag to or from the Toolbar to make it work how you want it to.

(It's actually a thing well worth poking around in, as the Toolbar can become quite powerful when you've bent it to your will. But we're not interested in that right now.)

Without closing your Finder window, open up System Preferences and the Printers & Scanners pane again. Then grab the icon representing your printer and, instead of dragging it to the Desktop or the Dock, drag it into the Toolbar of the Finder window you've got open and customisable. You should see the existing tools slide out of the way to make room for the printer icon. Position it wherever you want, and then click Done.

(One side note: to the left of the Done button, you'll see a drop-down menu labelled Show. This has three options: Text Only, Icon & Text, and Icon Only. Since printer names can be quite long and unwieldy, it's advisable to use Icon Only if you're adding a printer to the Toolbar.)

After that, any window you open in the Finder will have a printer icon in the Toolbar. Drag files from windows directly to that icon to print them.

What if you have one printer for text documents and another for photographs? Or an inkjet for drafts and a laser for final copy? No problem — you can set up as many of these proxy printers as you need and have the space for on your Desktop, Dock or Toolbar.

Of course, with either of these proxy methods, you don't get the full advantages of a Print Setup dialogue in case you want to change settings, print in Draft mode or anything fancy like that. These tips are only useful for quick-and-dirty standard printing with all of your defaults. ■



Metro: Last Light is one of the more demanding games on Linux and also comes with a built-in benchmark tool.

Get gaming on Linux

Matt Hanson shows you how to start enjoying playing games on Linux.

Gaming on Linux has never been better. With over 1,500 games available on Steam (store.steampowered.com) alone that support Ubuntu (officially 12.04 LTS and many other distros, unofficially), the breadth of games that you can get on Linux is astonishing: from casual card games and puzzles for whiling away a few hours, to indie games that might be low on budget but are high on inventiveness, and even big budget triple-A games are now available.

Games are also beginning to run better than ever on Linux distros now that many game engines used by some of the biggest names in the gaming industry — such as the powerful CryEngine.com — have native Linux support. Gamers switching from the bloated Windows OS to Linux can also see performance increases, as their system won't have to devote as much of its resources to background processes and, instead, concentrate on delivering the best gaming experience possible.

Not only is there a plethora of choice when it comes to gaming on Linux, it's now easier than ever to get started. Although Valve's proprietary store front has its issues — such as game

DRM — it does make installing and running games an incredibly simple process. It's also not the only game in the Linux-verse, Good Old Games (www.gog.com) is another service that sells games for Linux. It offers a mix of classic games (that have been made compatible with modern computers), new games and has a no-DRM policy.

Hardware manufacturers have also been upping their game as well, making good strides to ensure their graphics drivers are Linux-compatible, so that we can fit the most powerful gaming components into our machines. Of course, the beauty of Linux is that if you're not too keen on using the hardware maker's proprietary drivers, there's a dedicated community creating third-party open source alternatives.

Thanks to the large variety of games available on Linux, the PC you use should be able to run at least some of them — though older machines without dedicated graphics cards may struggle to run the more graphically intensive and newer games — however, you'll still be able to play some puzzle, indie and retro games.

If you want to give your PC a bit of a boost to handle more demanding

games, then you don't have to spend a fortune — a few modest upgrades here and there should give you a good experience when gaming. Most games — unless they are huge open world affairs — aren't particularly CPU-intensive, so if you have a semi-recent dual- or quad-core processor, then you'll most likely be fine to leave your CPU as it is. Modern CPUs, such as Intel's Core i5 and Core i7 range, also include pretty decent integrated GPUs as well, which means you might not even need to buy a dedicated graphics card to play many games. However, if your CPU is showing its age or you want to play more demanding games, then buying a dedicated graphics card is the best upgrade you can buy for your PC.

We have good news on two fronts here. First, most modern graphics cards play pretty nicely with Linux these days, so putting one in your system shouldn't cause any trouble. Both first- and third-party drivers are quite easy to install too (more on that in a bit) and they generally behave themselves.

The second bit of good news is that you don't have to spend a lot of money to get a capable graphics card. Sure, there are some ludicrously expensive

GPUs on the market, such as Nvidia's \$1,550 Titan X, but these are aimed at gaming enthusiasts. For entry-level and mid-range cards, you can get something decent for between \$120 and \$310, depending on the level of performance that you require. Despite these low prices, you should be able to run most modern games smoothly, thanks to most games being scalable for a variety of hardware configurations, so you might have to dial down an effect here or there, but you'll get smooth framerates.

Most modern games are also developed with the Xbox One and PlayStation 4 in mind, and despite being pretty new, these games consoles have relatively modest graphics capabilities compared to PCs. If you want to future-proof your gaming machine, a really general rule of thumb you can use when choosing a graphics card is that, if you want to run games at resolutions higher than 1080p, or on more than one monitor, then we'd recommend going for a GPU with 4GB of GDDR memory. However, for most casual gamers, this will be overkill, and any card equipped with 2GB should be plenty.

With this in mind, we'd suggest a graphics card like the Nvidia GTX 950, which is a great choice if you want to play most of the latest games at 1080p. It comes with 2GB of memory and goes for around \$240, which makes it excellent value for money. We got one in to test, in fact, and ran a number of benchmarks to see how good it performs.

BENCHMARKING

The first benchmark we ran was Heaven, which is a well-known benchmarking tool among gamers for seeing how well a graphics card performs. You can download the RUN file from <http://bit.ly/UnigineHeaven>. Once downloaded, open up the Terminal and type:



The Steam library lists all the games that you've purchased. Once bought, you can download and play a game on any machine as long as you've logged in once to your account.

```
cd ~/Downloads
chmod 700 Unigine_Heaven-4.0.run
sudo ./Unigine_Heaven-4.0.run
```

...to install the benchmark. To run it, change directory into the Heaven folder and type `./heaven`. A screen will appear asking you what type of benchmark you want to perform. Click OK and an animated video will appear, putting your GPU through a workout. On the top-right hand corner of the screen, you'll see a counter for frames per second – the higher it is, the smoother the gameplay will be.

The test computer we're running the benchmarks on has an Intel Core i7-6700K processor, Intel's sixth-generation Core i7 flagship. It's one of the best CPUs around, and though it's a bit pricey at around \$515–\$585, it's got good future-proof qualities, with support for new DDR4 RAM and a powerful integrated Intel HD Graphics 530 GPU.

Without a dedicated graphics card, the Intel Core i7-6700K reached an average of 7.9 frames per second (fps), with a minimum fps of 5.6 in the

Heaven benchmark. In comparison with a GTX 950 GPU installed, the Heaven reached an average of 39fps and a minimum of 20.4fps.

We also benchmarked the GTX 950 in *Metro: Last Light*, a graphically demanding first-person shooting game that was the first AAA game to be available for Linux. At full 1080p resolution, the GTX 950 hovered around the 50fps mark for most of the run, offering a smooth gameplay experience. However, we found there were sudden drops to 36fps when things got busy – though the graphics settings were set to maximum.

If you want a more consistent framerate, then you can lower some of the graphical details, and it will still look lovely. It's certainly better than the integrated graphics that is on the Intel Core i7-6700K, which only managed 21fps in *Metro: Last Light* – and that was while running the game at the lowest graphical settings, too.

INSTALLING A GPU

It's clear, then, that if you want to play graphically demanding big-budget games, a dedicated graphics card is a must-have on your shopping list.

Wine for games

Wine (which stands for Wine Is Not an Emulator) is a compatibility layer that enables Windows programs to run on Linux. Although it's usually used for running office suites and other programs that haven't made it to Linux (or don't have an open source alternative), it can also be used for running Windows games in Linux. Of course, there's a performance impact to running a game via Wine rather than natively, so it's not really recommended for graphically demanding games – unless you have one hell of a machine. However, if you have CDs of some old Windows games lying around, or you want to try an indie that hasn't made it to Linux just yet, then Wine is a great possible solution.

To install, open up the Terminal and type:

```
sudo add-apt-repository ppa:ubuntu-wine/ppa
sudo apt-get update
sudo apt-get install wine1.7
```

...and a window will pop up asking you to read and agree to a EULA by Microsoft. You might have hoped you'd left all this behind, but it's a necessary step to using Wine. Once you've scrolled down and agreed, type in `$ winetricks`. To run the graphical user interface for Wine. You may have to install additional packages, and Wine will take you through the process. With 'Select the default wineprefix' selected click OK and then you can begin installing required software to run Windows games in Linux.

Graphics cards are relatively straightforward to install. All you need to do is turn off your machine and pop off the side to get to your motherboard. The graphics card slots into the primary PCIe slot – check your motherboard's manual (or run a quick online search) if you're not sure, though most motherboards are clearly labelled up.

One of the best things about putting together a PC is that it's pretty hard to plug something into the wrong port or slot – they just won't fit. The PCIe slots have a little lever at one end of them and pressing these down helps eject the graphics card if you want to remove or replace it, so when installing, you might have to angle the card so that the small cutout in the card fits under the lever. You'll also have to make sure that there's a gap in the chassis of your PC to allow you to reach the ports of the graphics card when it's installed. To create a gap, most chassis allow you to unscrew a thin metal grille to give access to the card's ports. Find the grille that aligns with the PCIe slot you're going to be installing the card in, and use a screwdriver to unscrew the screws holding it in place – but make sure you keep hold of the screws. Remove the grille cover and then insert your graphics card into the PCIe slot. Now use the screws that you kept hold of and use them to secure the graphics card in place.



The Heaven benchmark will stress test your graphics card to see how well it performs.

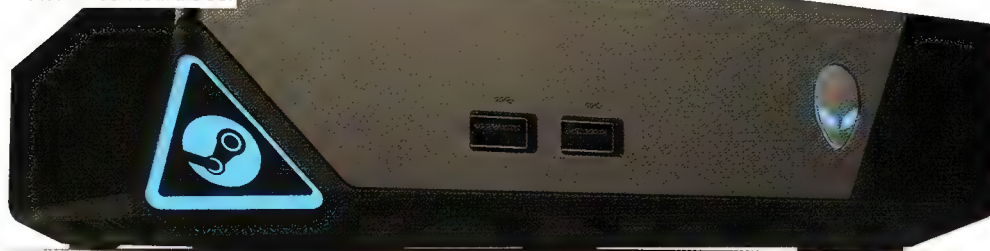
Many graphics cards, especially the more powerful ones, require that they are plugged in to your computer's PSU (power supply unit), so check to see if the card has one or even two of these PCIe six- and eight-pin sockets. Your PSU should have a cable running from it with matching connectors. If not, Molex adaptors should be provided with the card; however, any good 500W PSU should provide at least one of these and we'd recommend upgrading if yours does not. You can now close up your PC and attach your

monitor to your graphics card and power it on.

All going well, your PC should boot and you'll see the desktop environment of the distro that you're running. Steam, which has the biggest collection of Linux games, runs on Debian-based systems, though only Ubuntu with Unity, Gnome or the KDE desktop are officially supported. We've run Steam on other Debian-based distros, Mageia and Arch with success, for the ease of this feature we're running the latest version of Ubuntu.

Because of the growing number of Linux gamers, both Canonical and Nvidia have worked together to make installing graphics drivers a lot easier. When Ubuntu is loaded, you should see a message pop up saying that 'Restricted drivers are available'. Click this message and a window will open up listing a range of drivers that you can install. A recommended driver for your system will be highlighted, but it's worth

Alienware is one of the big names that has built and released a Steam Machine in the US.



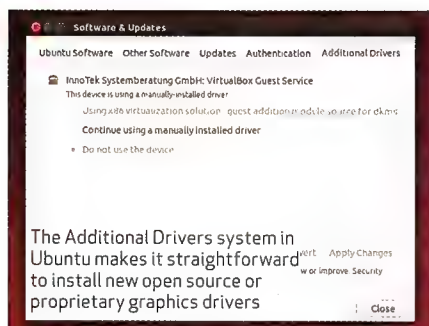
Steam Machines

Valve, the company behind the Steam platform, has been promising to disrupt the way we play games in our living rooms with Steam Machines. These are compact gaming PCs designed to replace gaming consoles, such as Xbox One and PlayStation 4. Running SteamOS, Valve's Debian-based distro, the first commercially available boxes went on sale in the US in November of last year.

Steam Machines are being made by a variety of manufacturers, such as ASUS and Alienware, and come in all different shapes and sizes. This means that if you don't want to build a gaming machine yourself, you may be able to find one that suits your needs and budget. Valve isn't selling these down under yet, but the US Steam Store offers units with prices

starting from US\$449 (or around \$620 — quite a bit more than a PlayStation 4 but with a heck of a lot more power) to a wallet-numbing US\$4,999 (around \$6,930) for Falcon Northwest's Tiki with its granite base. You can find out more about Steam Machines on Valve's own Steam website at http://store.steampowered.com/sale/steam_machines.

If you'd prefer to play your games with a controller rather than a keyboard and mouse, then many USB controllers will work plug-and-play with Linux and SteamOS, even Microsoft's Xbox 360 controller. Valve has also created its own Steam Controller (US\$50, AU price TBC), with the unique device supposedly making it easy to control games that usually use mouse and keyboard controls with the gamepad.



checking some of the drivers as there will be information regarding whether the drivers are proprietary or open source. You can also install drivers from the terminal. Open it up and type `sudo Ubuntu-drivers devices`.

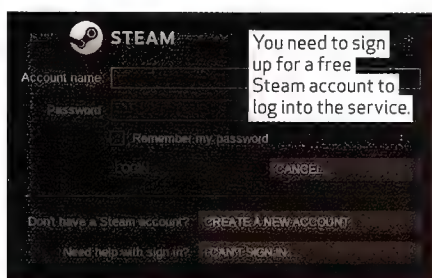
This gives you a list of possible drivers; e.g. for an Nvidia graphics card, it could list:

```
driver :xserver-xorg-video-nouveau
-distro free builtin
driver :nvidia-304-updates - distro
non-free
driver :nvidia-331 - distro non-free
recommended
```

If we wanted to install the latest official proprietary driver from Nvidia, which Ubuntu recommends, then we would then type:

```
sudo apt-get install
nvidia-331
...to install.
```

You may notice that this isn't the bleeding edge proprietary driver from Nvidia, but it will likely run most indie games. For more graphically demanding games, such as *Middle-earth: Shadow of Mordor*, you'll need a more recent driver. In the past, this has meant either downloading and installing a driver manually from the Nvidia – which is probably too much Terminal exposure for most newcomers – or adding and enabling extra repositories (repos) to stay up to date. The latter option used to mean relying on third-party repos (e.g. `ppa:ubuntu-x-sw/updates` for the latest stable), but in an exciting and recent development, Ubuntu has set up an official PPA especially for Linux gamers wanting the latest drivers. To fetch them, add and enable the PPA using:



The Nvidia GTX 950 is a very good graphics card for its price, though if you want a bit more oomph you'll need to spend a little extra

```
# sudo add-apt-repository
ppa:graphics-drivers/ppa; sudo
apt-get update
```

To upgrade to or install the latest driver, use `# sudo apt-get install nvidia-current`. If you're concerned about these drivers making your system bleed – most newly released Nvidia drivers can tend to have their teething problems – then we'd advise sticking to the `x-sw/updates` PPA. To roll back changes made by the PPA, use `sudo ppa-purge ppa_name`.

If you have an AMD graphics card and want to install the latest official drivers, then you can download and install the AMD Catalyst program, which gives an easy-to-use graphical interface for installing the latest drivers. If you have previously installed an AMD card, you'll need to remove the old drivers by opening up the terminal and type in `sudo aticonfig --uninstall`. Next, enter `sudo sh ./amd-driver-installer-x86-x86_64.run` into the Terminal. Where it says 'amd-driver-installer-x86.x86_64.run' you'll want to double check that it's the most recent driver for your card on AMD's website (support.amd.com). A window will open allowing you to complete the installation. A word of warning, before updating your kernel down the line, remember to remove the proprietary driver.

GAME SERVICES

Now that your Linux machine is ready to play games, the big question is where can you get games to play? Steam is the obvious choice as it has a huge collection with a decent mix of genres and game types. It also features some nifty features such as cross buy, so you can buy a Linux game, and if it's compatible with Windows or Mac, you can play it on those operating systems as well without having to pay for another copy. Many games on Steam

also support cloud saving, so you can save your progress on one machine and switch to another and carry on playing where you left off.

To install Steam in Ubuntu, you can either search for it in the Software Center or open up the terminal and type `sudo apt-get update` and then `sudo apt-get install steam` to install Steam. Once installed, you will need to sign in with, or sign up for, a Steam account. After that, buying, downloading and installing games through Steam is a piece of cake.

Good Old Games is another great service that's now supporting Linux. Although it's not quite as straightforward as buying through Steam, its GoG Galaxy application takes plenty of cues from the Steam client (but isn't currently available for Linux, you have to use the launcher), but it does come with its own pros, such as it only sells DRM-free games and it guarantees games to run on supported platforms or your money back. Also, as you can probably guess from the name, it started out specialising in old games, repackaging them so that they work on new hardware and operating systems. Of course, it also features new games as well, and you can view and download games from www.gog.com.

We'd normally recommend taking a look at Desura, too (www.desura.com), which has a host of both free and paid-for Linux indie games, but Desura's parent company filed for bankruptcy in June, and aside from Humble Bundle offering its assistance (www.humblebundle.com, and another great source of Linux games), there's been no official word on its future yet. The site is still up, so the choice to buy is your own.

Regardless of the game service you decide to use, you should now have a Linux machine that's fully ready to play the latest and greatest games. ■



AMD gets back in black

We took some high-end AMD parts and put them into this darkly beautiful rig.

CHECK ONE TWO

Sometimes, it can be incredibly tempting to go with what's familiar. For us, Intel tends to be our preference when we look for a performance CPU. But we asked ourselves: what if we went full-on Team Red?

Sure, AMD doesn't make a part that can compare to the Core i7-5960X, but that doesn't mean it doesn't offer some good CPUs. And on the upside, you generally pay less for an AMD CPU, which means that gamers or builders on a budget can still have a good experience without as much of a hit to the wallet. After all, the 5960X is almost \$1,600.

We also wanted to find an excuse to build into the NZXT Noctis 450 that had been sitting in our office for a few months. Once we opened the box, we wondered why we hadn't built into it earlier. The Team Red theme went together with the black and red accents of the case perfectly.

We feel like this build is a great example of what you can do with the darker, redder side of the PC parts market. Combined with the red accents on our GPU and RAM, this build really shines as one of our favourites in terms of aesthetics.

SYSTEM-BUILD INGREDIENTS

PART		STREET PRICE
CASE	NZXT NOCTIS 450	\$200
MOTHERBOARD	ASROCK FATALITY 990FX KILLER	\$220
CPU	AMD FX-9370 BLACK EDITION	\$320
MEMORY	8GB CORSAIR VENGEANCE DDR3-1600 (RED)	\$69
GPU	ASUS RADEON R9 FURY STRIX	\$970
PSU	CORSAIR RM650 (80 PLUS GOLD)	\$170
HDD	3TB SEAGATE BARRACUDA	\$150
SSD	250GB SAMSUNG 850 EVO M.2	\$135
CPU COOLER	COOLER MASTER NEPTON 280L	\$155
TOTAL		\$2,389



The set list

When we started piecing together this rig, we went hunting around our lab for AMD parts we had on hand. We happened upon the foundations of what would make our build: an eight-core AMD FX 9370 and an ASRock Fatalty 990FX Killer mobo.

The FX 9370 makes use of AMD's Vishera core, which is a little on the thirsty side. With a TDP of 220W, we had to make sure we cooled it if we wanted to keep it stable, so we grabbed a Cooler Master Nepton 280L, with its big 280mm radiator.

As for video, we couldn't resist using our ASUS R9 Fury Strix. Although it's not AMD's biggest, baddest GPU (the 9370 isn't the top of AMD's offerings either), the Fury holds its own. Think of the Fury and the Fury X in the same terms you would the 980Ti and Titan X.

As for the rest of our contraption, we nabbed 8GB of Corsair Vengeance RAM to fill two of the four DIMM slots on our 990FX mobo. And keeping with our theme, the RAM had to be red.

For storage, we went with a 250GB M.2 Samsung 850 EVO and a 3TB

Seagate Barracuda spinning drive.

The power supply was tricky. As we were in the midst of moving office, we had a hard time finding a PSU that would be a good match. We eventually found a Corsair RM650, which worked well. However, if you want to overclock this GPU or CPU, go find a PSU rated at least 750W. The 650W unit got our benchmarks done without a problem, but we'd really like the extra headroom for overclocking.

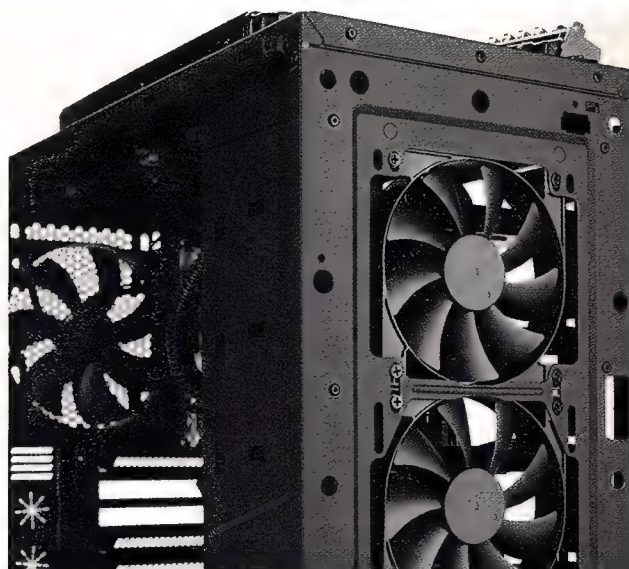


1 FLYING HIGH AGAIN

The Nepton 280L kept us cool during tests, but before we could run them, we had to mount the big radiator somewhere. The Noctis 450 is a midtower, so there's not much room inside. But there's plenty of room up top.

With a little effort making sure to release all the round catches at the top of the inside of the case, you can release the whole top plastic molding in one piece. We found that, if you put it in just the right spot, you can place the big 280mm radiator on top of the fan mounts and still get the top to attach properly. This is a big space saver, and also helps support the big radiator.

Luckily, this case isn't built with 5.25-inch optical drive bays in mind, so we could snake the tubing for our cooler in the "drive bay" where the ODDs would normally go.



2 ROCK YOU LIKE A HURRICANE

Most builders know that AMD parts can get toasty under load, so good cooling is essential. As we had our CPU covered with a 280mm radiator, we needed to make sure our R9 Fury got all the airflow it could handle.

The Noctis 450 comes with four case fans: one up front, two up top and one in the rear. Since we wanted to place our CPU cooler up top, we moved those two fans to the front to help keep the Fury fed with fresh air. We also mounted our radiator with a pushing exhaust configuration, so making sure we had enough cool air for the radiator was a must. When we snapped the front panel back on, there were no lights from the fans or front of the case, which made for a sleek black matte look that really impressed. You don't need LEDs on all your parts. Even if we had LED fans up front, we doubt we'd be able to see them.



3 NO SHELTER

We've become big fans of using an M.2 form factor SSD whenever possible. This Samsung 850 EVO is no exception.

Don't expect NVMe speeds here. This SSD runs pure SATA mode and offers the same speed as a 2.5-inch model. But both the 2.5-inch and the M.2 are about the same price, so why not go M.2? It saves on cabling mess and improves our airflow.

The only downside to installing an M.2 SSD is you have to install it before your video card. The other upside is that when you finally do want to upgrade to NVMe, you've got the platform to do so. On most motherboards, the switch from SATA to NVMe mode can be made with the help of a simple BIOS option.

Of course, another downside to using M.2 is that your storage isn't shielded behind a plastic or aluminum casing. It's exposed to mishaps and damage if you're not careful.

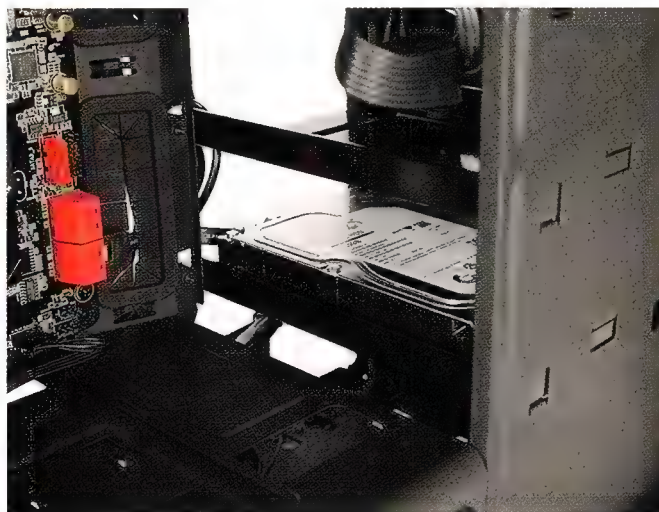


5 THE PATIENT

Working on a PC can feel like working in an operating room. In this build, one of the more hairy parts was trying to install the GPU. Just as that hard drive partition makes life painful when messing with your hard drives, it also made things interesting when installing our R9 Fury Strix.

At around 30cm long, the R9 Fury Strix needs a lot of space in a case. The space was there in the Noctis 450, but it took a bit of wiggling to get the GPU put in place. To do it, we had to back the card into the hard drive cage partition before moving it forward to insert and seat it in its rightful slot. This wasn't difficult, but it did require a bit of patience.

If we wanted to add a card to use in CrossFire, it would be interesting to try to fit it in. On the plus side, the GPU looks handsome, while conforming to our black-and-red theme.



4 THE MEMORY REMAINS

When we installed our 3TB Barracuda, we realised you can't see the drive easily from the "front" with the panel off. NZXT decided to build a partition in the Noctis 450 that makes the drive inaccessible from the front. Instead, you have to take off the "back" panel to add or remove hard drives. This can be a pain in the bum when your cable management makes it difficult to get the back panel closed in the first place.

As much as that can be an annoyance, there is a bit of logic.

By mounting drives this way and keeping that partition, the build looks cleaner with the "front" panel taken off. It also helps channel air from the fans toward the PCIe slots and CPU, as opposed to letting it fly about everywhere.

We just recommend steering away from the idea of using this case if you'll be swapping out hard drives often; opening the back panel is rarely fun.



6 UNDER THE SURFACE

One of the reasons this build looks so clean is the power supply partition that NZXT built into the Noctis 450.

Such partitions are often underestimated, but they help the build stay organised. If you don't have a modular PSU, spare cables can be coiled and zip-tied away inside the partition. The loose end of SATA and power cables, too, can find a home there. The partition also allows for dedicated airflow for the PSU (and more optimised airflow for the motherboard compartment), and can keep heat contained.

The downside is that installing your PSU is not as straightforward. You can't just plop it in place. Instead, you have to slide the PSU into position, often by removing a bracket, where you see the PSU mounting screw holes. And you have to mount the PSU with the fan facing downward, as there isn't a lot of room for efficient intake from the top.



1 While we probably had enough room to mount the radiator below the bracket, keeping it up top gave us more space and kept things from looking cluttered.

2 The bevel line you see creates a channel for stowing big cables, keeping cable bulge to a minimum.

3 Using the cutouts in the top of the PSU partition makes routing audio and USB connections much cleaner.

4 While it would look gaudy on other cases, the underglow effect is nice because it's the only external LED lighting on the all-black case, save for a red LED.

The Solo and Breakdown

When we were all finished, this was one of our favourite builds in terms of looks. The interior looks clean, and the red-and-black theme has a darkly evil appeal reminiscent of *Command & Conquer's Brotherhood of Nod*. But looks aren't everything.

When we ran our graphics benchmarks, we couldn't really expect a single Fury to stand up to the wrath of three GTX 980s. However, this system did offer some promising marks.

The *Shadow of Mordor* benchmark returned a score of 44.2fps on average at 2160p. That's enough to make it into the playable realm at 4K, no easy feat.

Tomb Raider didn't fare as well at 4K, with 38.5fps. That's too close to 30fps for our blood. However, if you really want to play *Tomb Raider* at 4K, turning down (or off) antialiasing could bump up the frame rate. With these marks, playing at 1440p would be just fine.

In *Batman: Arkham City*, we saw what this card could do at 1440p. Again, the marks aren't as high as a GTX 980 Ti would be, at 89fps, but they are playable. With a FreeSync monitor, playing at that resolution would be enjoyable.

Remember that these benchmarks are stress tests with all (non-GPU-specific) settings maxed out. Turning down settings can yield dozens of extra frames per second.

When we fired up 3DMark Fire Strike Ultra, we saw our rig get a respectable

score of 3,515, comfortably above the Oculus Rift recommended spec score of 2,596.

Our CPU benchmarks returned much lower scores than the i7-5960X in our zero-point. Though the Vishera's octa-core offered more than a quad-core, the 5960X's hyperthreading, smaller process (22nm versus 32nm), and higher L3 cache (20MB versus 8MB) produced a faster machine. But the 5960X is a \$1,000 CPU. The FX-9370 is \$210.

The single-threaded benchmarks returned a much smaller delta than the corresponding difference in price. Considering that the FX-9370 costs 79% less than the 5960X, a delta of about 40% in *Stitch* and 23% in *ProShow* isn't all that bad. Once we got into our multithreaded benchmark,

the performance gap widened to canyon-size.

The 5960X has more L3 cache and hyperthreading, so instead of eight logical CPUs, it has 16. That's twice what the Vishera offered, and the FX-9370 fell behind.

On the bright side, the CPU stayed cool with the help of the Nepton 280L. During the CPU-intensive x264 encoding test, we saw a peak CPU temp of 52°C. Likewise, *Fire Strike Ultra* only topped out at 48°C. That leaves plenty of thermal headroom for overclocking.

If there is one thing we could have done differently, it would be the power supply. Going with a 750- or 800-watt PSU would give you all the headroom you need to overclock safely. We weren't comfortable with the idea of only 650 watts to work with. ■

LABS RESULTS: AMD SYSTEM BENCHMARKS

	TEST RIG	THIS PC (% CHANGE)
STITCH.EFX 2.0 (SEC)	806	1,087 (-34.9%)
PROSHOW PRODUCER 5.0 (SEC)	1,472	1,814 (-23.2%)
X264 HD 5.0 (FPS)	33.8	13.3 (-60.7%)
BATMAN: ARKHAM CITY 1440P (FPS)	204	89 (-56.4%)
TOMB RAIDER 2160P (FPS)	87.5	38.5 (-56%)
SHADOW OF MORDOR 2160P (FPS)	70.1	44.2 (-36.9%)
3DMARK FIRESTRIKE ULTRA	8,016	3,515 (-56.1%)
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%		

Our labs testing PC uses a Core i7-5960X CPU, three GTX 980s, and 16GB of RAM. *Arkham City* tested at max settings with PhysX off. *Tomb Raider* at Ultimate settings. *Shadow of Mordor* at Max settings. ■

Use an Xbox or PlayStation gamepad with your Pi

Mayank Sharma explains how to hook your Pi up to a game controller.

Video games in the 1980s were quite different from the latest crop of frag-'em-'til-you're-dead point-and-shoot games. They were tastefully crafted 8-bit graphical masterpieces, with intense storylines and gameplay that kept you engrossed for hours. If reading this makes you feel nostalgic, you can emulate the golden era of gaming consoles on your modern hardware and escape.

The new quad-core Raspberry Pi 2 has enough number-crunching power to virtually recreate the video game consoles of yesteryear. Most of the software that creates the defunct platforms is available as open-source software, which you can install on top of a Raspbian distribution (distro). However, the easiest way to start playing vintage games on the Raspberry Pi is to install the purpose-made RetroPie distro, which packs a bundle of emulators.

You can manually install RetroPie on top of an existing Raspbian distro but it's more convenient to use the pre-baked image. In addition to Raspberry Pi 2, the distro works with the older models as well, so make sure you grab the correct image. You need to transfer this image to at least a 4GB card, either using the `dd` command in Linux, such as:

```
# dd if=retropie-rpi2.img
of=/dev/sdd
```

You also need a USB keyboard and mouse for some initial setup that you can't do remotely via SSH. We'll also hook up a compatible Wi-Fi adaptor to the Raspberry Pi, which won't work straight out of the box, but we'll get to that later. Most important of all, make sure you grab some gaming controllers to enjoy the games to the hilt, and RetroPie can work with various controllers, from cheap no-names ones to PS3 and Xbox 360 controllers.

Once you've prepared the memory card with the RetroPie image, insert it into the Pi, connect the controller, the Wi-Fi adaptor, the speakers and the USB input devices, hook it up to your HDMI monitor, and power it up. The Pi boots directly into Emulation Station, which is the graphical interface it uses to enable you to switch between emulators. The interface asks you to configure the controller. However, before we do that, we have to tweak a couple of settings. Press the F4 key on the keyboard to exit the Emulation Station, then head to XTerminal.

BASIC SETUP

The first order of business is to expand the image to take over the entire card. In order to do this, bring up Raspbian's configuration utility with `# sudo raspi-config` and select the first option to expand the filesystem. Once



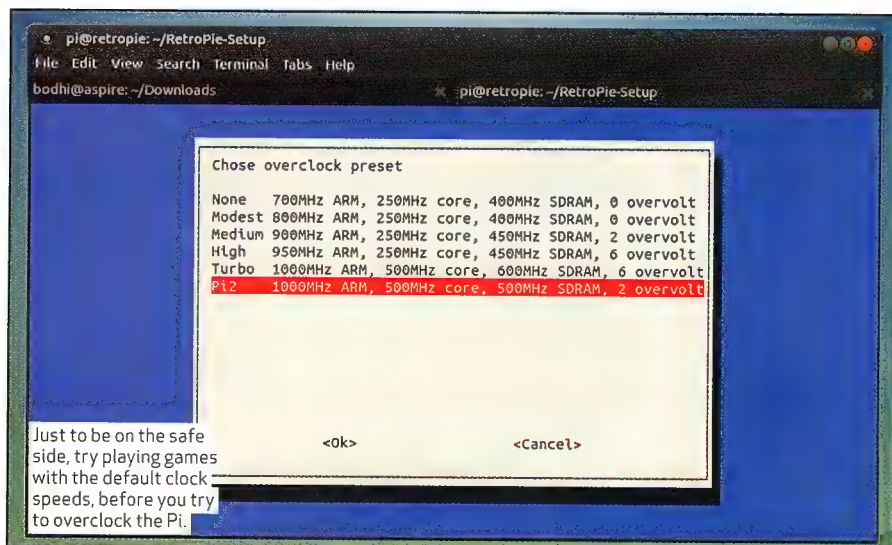
that's done, head to the second option to change the default password for the pi user.

Next up, head to the Advanced Options and select the SSH option to enable remote access. To ensure you use the maximum memory for gaming, head to the Memory Split option. If you're using a Raspberry Pi 2, allocate 512 to the GPU. Users of the older B+ model should earmark 256. Finally, scroll down to the Overclock option, where users of the Raspberry Pi 2 should select the Pi2 option. Once you've made all the changes, head back to the main menu and select Finish to restart the Raspberry Pi and save changes.

When you're back up again, press F4 once more to exit out of Emulation Station. We'll now get the Wi-Fi adaptor to work. Open the configuration file with `# sudo nano /etc/network/interfaces` and then change its contents to resemble the following:

```
auto lo
iface lo inet loopback
iface eth0 inet dhcp

allow-hotplug wlan0
auto wlan0
iface wlan0 inet dhcp
```



Upgrade RetroPie

The RetroPie script is a wonderful tool that you can use to convert a stock Raspbian distro into the ultimate arcade machine. Or if you are already running a version of RetroPie, you can use the script to update to a newer version without downloading and reinstalling the whole thing all over again.

To upgrade your installation, exit Emulation Station and enter the following in the CLI:

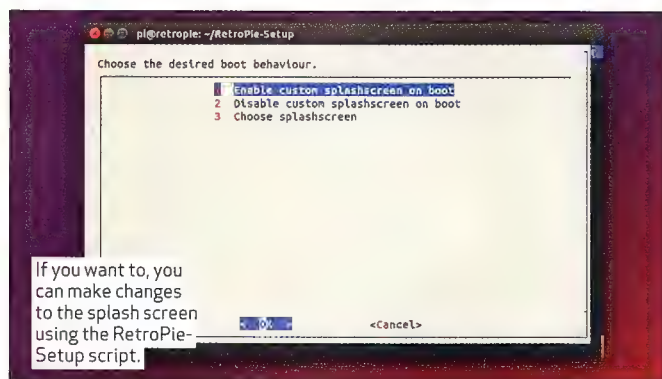
```
# sudo apt-get update
# sudo apt-get upgrade
```

The above commands refresh the distro's repos and brings it up to date by re-installing any outdated packages. With the base distro updated, it's time to update the various gaming emulators.

Again on the CLI, type:

```
# cd RetroPie-Setup
# sudo ./retropie_setup.sh
```

As you are in the script, the first task is to update the RetroPie-Setup script itself. The script lists two different upgrade options at the top. The first one fetches pre-built binaries of the emulators, while the second one compiles them from source. The former option is faster, while the latter, although excruciatingly slow on the Raspberry Pi, fetches the bleeding-edge versions of the emulators. You can safely ignore the second option and just go with the first one, which downloads and sets up new versions of all of the emulators.



```
wpa-ssid "Your Wireless
Network Name"
wpa-psk "Your Wireless
Network Password"
```

Make sure you replace the text in the `wpa-ssid` line with the SSID and password for your Wi-Fi network. Press Ctrl-X to save the file and exit the text editor. Now reboot the Pi with `sudo reboot`. Once it comes back up, your Wi-Fi adaptor connects you to your router. From this point on, you can do the configuration remotely from another computer.

Exit Emulation Station yet again and make a note of the IP address RetroPie has been assigned by your router. Assuming it's `192.168.3.111`, you can now log in to it from another computer with `sudo ssh pi@192.168.3.111`.

Irrespective of how you're accessing the Pi, the next order of business is to tweak some RetroPie-related settings. Change into the **RetroPie-Setup** directory with `# cd ~/RetroPie-Setup` and execute the configuration script with `# sudo ./retropie_setup.sh`.

The script fetches any required packages that are missing from your installation. When it's ready, the script displays an Ncurses-based menu. First up, scroll down to the second-to-last option, which updates the RetroPie-Setup script itself. Once it's done, relaunch the script and scroll down to

the third option, labelled **Setup/Configuration**.

In here, scroll down and select 323, which makes the necessary changes to display the RetroPie configuration menu in Emulation Station. This helps you make changes to the distro without heading back to the command line. Now, depending on your audio gear and how it's connected to the Raspberry Pi, you might need to handhold RetroPie before it can send audio output correctly. Select option 301 to configure the audio settings. If the default auto option isn't playing any sound, scroll down and select the output to which your speakers are connected. The menu also gives you the option to bring up the mixer to adjust the volume.

CONFIGURE CONTROLLERS

Now reboot the distribution one last time and, this time, continue with Emulation Station. If you've connected your controller, the distro will pick it up. Press and hold any key on the controller to help the distro correctly identify the controller. You will then be asked to map the keys on the controller. Be aware that this basic mapping is only for navigating around the graphical interface and helping you switch between the emulated system and selecting a game. Once you've set up the controller, you're dropped into the main menu of the Emulation

Station interface. Now, to set up the controller for gaming, head to the RetroPie menu in Emulation Station and select the "Configure RetroArch Keyboard/Joystick" option. Use the keyboard and select the first option, labelled "Configure Joystick/Controller". Then follow the on-screen prompts to set up your controller. If your controller doesn't have the buttons you're being asked for, just wait for a few seconds and the setup will move on to the next button.

CONTROLLER DRIVERS

If you use an Xbox 360 or a PS3 controller, you first have to install their drivers before RetroPie can pick them up. In earlier versions, this involved some hacking on the command line. However, in the latest version of the distro, it's a very simple and straightforward affair. Head to the RetroPie-Setup option in the RetroPie menu inside Emulation Station. This brings you to the Ncurses menu of the RetroPie-Setup script we were in earlier. Use the keyboard to select the third option to configure the distro. Scroll through the list and select the relevant option to install the driver for your controller – 318 to install the PS3 driver and 332 to install the driver for the Xbox 360.

The Xbox 360 script downloads the `xboxdrv` driver and edits the `/etc/rc.local` file to start the driver on boot. The

script adds entries for wired 360 controllers. If you are using wireless controllers, open the `/etc/rc.local` file in a text editor, hunt for the lines that begin with `xboxdrv` and replace the `--id` option with `--wid`.

If you are using PS3 controllers, once you've installed the drivers using the script as described earlier, you're prompted to plug in the Bluetooth adaptor for the controllers. Even after you do so, RetroPie will fail to detect your controllers. This is to be expected,

according to the developers. Exit the script and out of Emulation Station. Once you're back on the command line, switch to the `/opt/retropie/supplementary/ps3controller/` directory and type `# sudo ./sixpair`.

This nifty little utility should detect the Bluetooth adaptor and make it known to RetroPie.

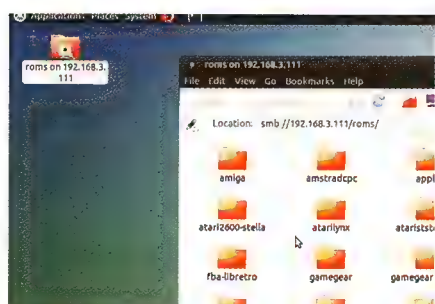
Now reboot the Raspberry Pi and, once it's back up, change to the `/dev/input` directory and list its contents with `ls`. If your controller has been

detected, it's listed as `js0`. You can test the controller by using:

```
# jstest /dev/input/js0
```

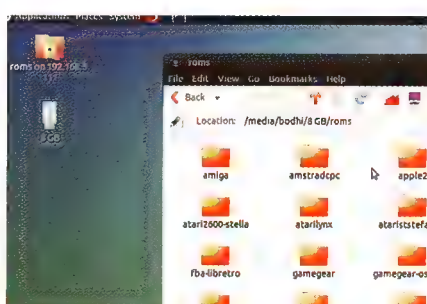
...which brings up the `jstest` program designed to test the features of a controller. Now head back to the RetroPie menu in Emulation Station and use the "Configure RetroArch Keyboard/Joystick" option to set up your controller. And that's it — your controllers are now all set up and ready to go. You can do this with all your controllers and RetroPie saves the

Transfer ROMs



1 NETWORK TRANSFERS

If RetroPie is connected to the router, you can transfer game ROMs to it from any computer on the same network. The distro ships with a pre-configured Samba server and shows up as a Windows share. Copy the ROMs inside the directory for their particular emulator.



2 VIA USB

The easiest way to transfer ROMs is to use a USB flash drive. When it detects a USB disk, RetroPie creates a directory structure for ROM files that mirrors the emulators installed on the distro. Wait a while as it creates the directories and then remove the drive.



3 PLUG AND PLAY

Now put that USB stick into your desktop PC and copy the ROMs on to it, making sure to put them in the right folder. When you put this memory stick back into your Pi, RetroPie pulls the ROMs into the matching directory for the associated emulators automatically.

Use a virtual gamepad

Don't sweat if you don't have a gaming controller — you can create and use a virtual one from within your phone or tablet instead.

To create the virtual gamepad, head to the XTerminal and enter the following commands to install the required components:

```
# sudo apt-get update
# sudo apt-get upgrade
# wget http://node-arm.herokuapp.com/node_latest_armhf.deb
# sudo dpkg -i node_latest_armhf.deb
```

Once you have the components, switch to the root user with the `su` command. You're prompted for the root user's password (raspberrypi). Once authenticated, enter:

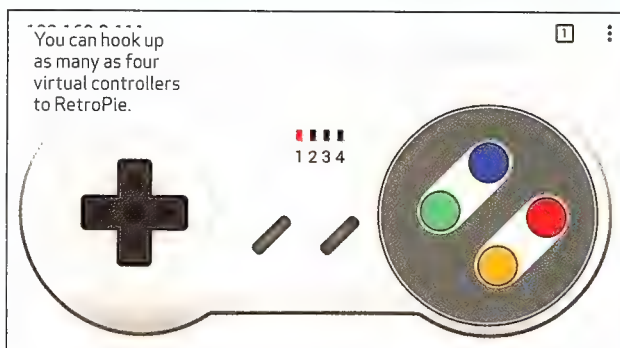
```
# git clone https://github.com/miroof/node-virtual-gamepads
# cd node-virtual-gamepads
# npm install
# npm install pm2 -g
```

The above steps take a little time to complete. Once they've finished, you can launch the controller and enable it to start up automatically at boot:

```
# pm2 start main.js
# pm2 startup
```

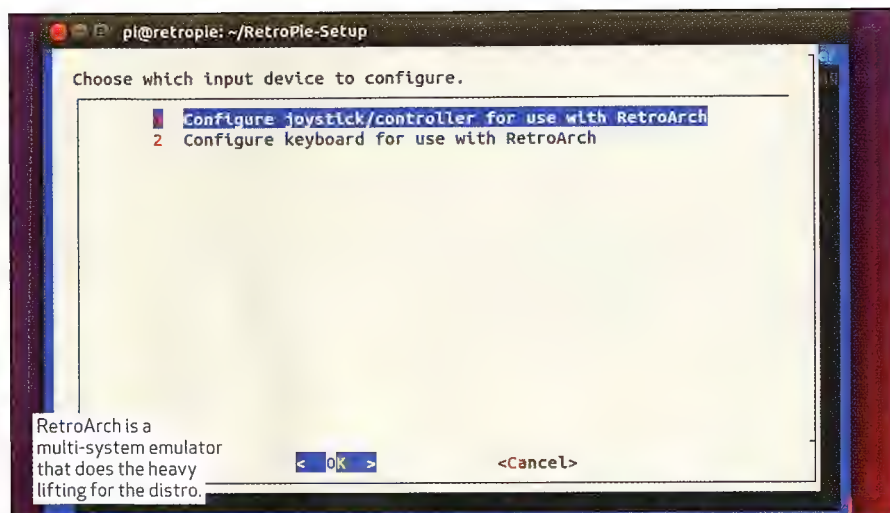
```
# sudo pm2 save
```

Now grab your phone or tablet, open the web browser (the developers recommend Google Chrome for best results) and enter the IP address of the Pi in the address bar. You should now see a virtual controller on the page. Note that you need to configure your controller with a RetroArch just as you would with a physical controller. The game controller web application also provides haptic feedback — if you find it irritating, you can deactivate it by taking your device off vibration.

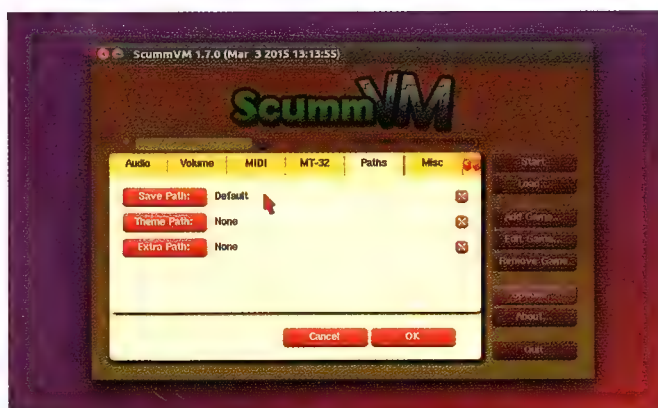
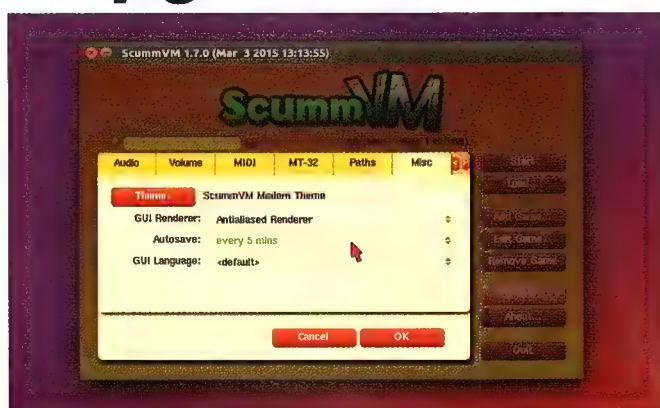


configuration and automatically loads it whenever you plug the controller in.

You can now scroll through Emulation Station and play the pre-installed games with your controllers. When you're done with those, follow the walkthrough to transfer your own gaming ROMs into the RetroPie. There are several websites, such as World of Spectrum (www.worldofspectrum.org), that host legally downloadable ROMs for free, donated or abandoned by their developers. True retro gaming fans will have created their own ROMs from old cartridges, though, which isn't too tricky thanks to adaptors like the Retrode.



Play games in ScummVM

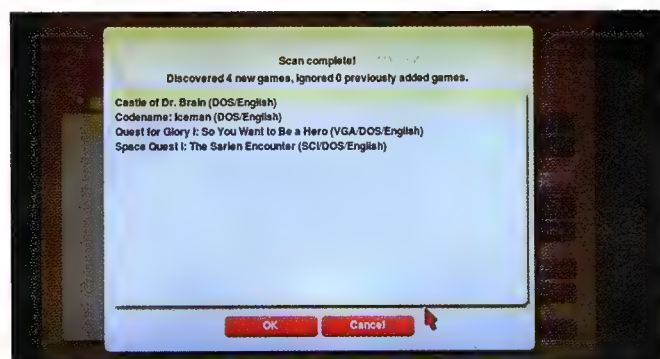


1 CONFIGURE SCUMMVM

Start the launcher and click on the Options button. Switch to the last tab, which houses miscellaneous settings. Use the Theme button to change the visual appearance of the launcher by switching to another theme. The GUI Renderer setting defines how the launcher is rendered, and the Autosave option controls the length of time that ScummVM waits between saves.

2 DEFAULT PATHS

Switch to the Paths tab to configure where ScummVM looks for particular files. The Save Path option points to the default folder where ScummVM will store saved games. If the option isn't set, the saved games are stored in the current directory. Then there's the Theme Path option, which points to the directory that stores additional themes for the launcher.



3 ADD GAMES

To load a supported game into ScummVM, copy its data files from the original media. If you've downloaded the files from ScummVM's website, you have to extract them before copying them into RetroPie. Then run ScummVM, press the Mass Add button and point ScummVM to the extracted folder. It auto-detects any games in there and they appear in the game list.

4 GLOBAL MENU

Now select the game you wish to play and press Start. While playing the game, you can press the Ctrl-F5 key combination to pause the game and bring up the global menu. This gives you the option to get help and influence gameplay. Using the Help button, you can access any in-game help documentation, while the Options button enables you to tweak certain settings, such as volume.

High-speed charging on Marshmallow

New Android devices will likely promise lightning-fast charging speed, but it may not always be easy to get. Darren Yates looks at the new tech coinciding with Android 6.0.

Google's new Marshmallow release is here and faces a mobile market enduring mixed fortunes. According to research analysts IDC, global tablet sales for the third quarter of 2015 fell seven million, down 12.6% compared with the same period last year. Samsung sales were down 17.1% year-on-year for the period, while it also appears we've passed "peak iPad" period, with Apple tablet shipments dropping from 12.3 million to 9.9 million, a slump of nearly 20% (tinyurl.com/na5jlf5).

By contrast, smartphone sales have turned a corner, with global shipments for Q3/2015 topping 355.2 million, up from 332.6 million for the same quarter in 2014. Samsung managed to ship almost five million more phones for the period, up to 84.5 million and Apple offset its tablet slump, growing iPhone sales by 22.2% to 48 million for the quarter, up from 39.3 million in Q3/2014 (tinyurl.com/ot7zroo).

But while new phones come with an amazing array of features, a Fortune magazine online survey earlier this year found the most popular response was "better battery life" when consumers were asked about the most exciting new smartphone features

(tinyurl.com/oceddtg). As global markets mature, Google's new Android 6.0/Marshmallow OS coincides with new technology aimed at not only improving battery life, but speeding up how long it takes to charge a device. We took a preliminary look at the new 'Android M' back in our August 2015 issue of APC, but now it's here, we can look under the bonnet at some of the more technical and practical connectivity issues.

USB TYPE-C CONNECTIVITY & CHARGING

It's still less than ten years since the first Android phones. But in that time, the number of CPU cores found inside these devices has jumped from one to eight, screen sizes have doubled and, to compensate, battery capacities have grown upwards of three times. But while charging rates have also doubled, the technology is only just keeping pace with expanding battery capacities.

One of the features being touted for Marshmallow devices is the new USB 3.1 specification, which, in addition to 10Gbps data rates, will align with

changes to how the Universal Serial Bus is physically implemented. It coincides with new reversible Type-C connectors, cables with the same Type-C connector at both ends and the promise of "lightning-fast charging", thanks to both USB 3.1 and the equally new USB Power Delivery 2.0 specification.

In practice, achieving high-speed charging via USB Type-C cables won't be guaranteed everywhere. The new Type-C specification allows for up to 3.0 amps of charge current through Type-C connectors, but these connectors can also be used with legacy USB standards, thanks to dedicated pins for USB2.0 data (Google's Nexus 5X is a case in point). It means USB 3.1 and USB Type-C are not the same thing.

USING LEGACY USB TYPE-C CABLES

If you use all USB Type-C gear – cables, chargers, phones – all links in the

The Galaxy S6 comes with an Adaptive Fast Charging Charger.

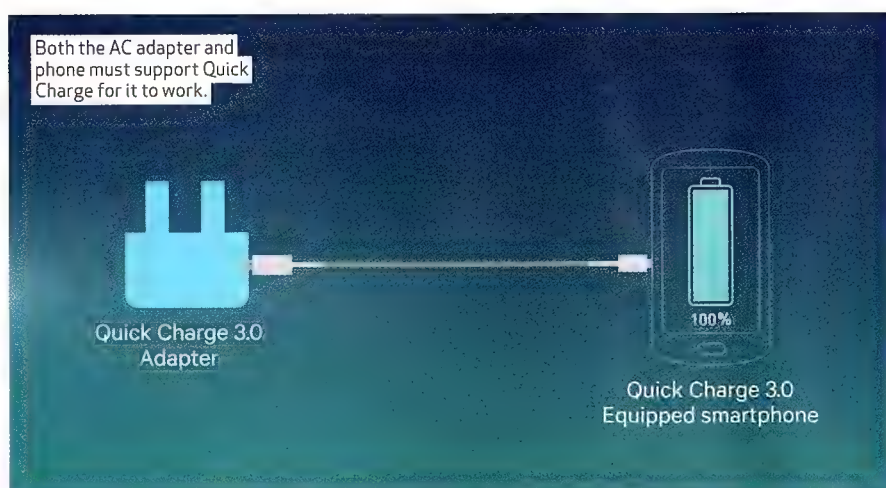
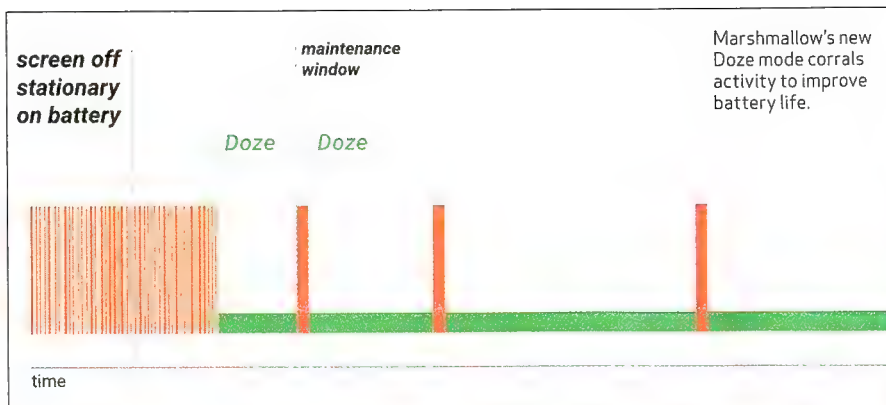
SAMSUNG



Reports are Google's Nexus 5X doesn't support Quick Charge (yet).



USB Type-C phone cables allow for up to 3.0 amps charge current.



chain are supposed to acknowledge each other and you should get your 3.0 amps of current. But as soon as you use a "legacy cable" that has Type-C on one end and Type-A on the other, the system negotiates the charge current expectations for those older standards. Otherwise, the device being charged will likely pull too much current from the legacy power source and probably blow it up. Blowing up an AC USB charger won't do your phone or tablet much good and popping a USB port on your laptop could be an expensive loss.

The problem is that, with so many different charging port specs and permutations, it's not just a matter of grabbing the appropriate connectors and whacking some USB cable between them.

NON-COMPLIANT CABLES

It's becoming such a significant issue that Google engineer Benson Leung is staging something of a crusade against non-complaint USB Type-C cables, going as far as naming and shaming compliancy offenders online.

Here's what's supposed to happen with legacy cables — USB Type-C gear looks for certain voltage levels on the Configuration Channel (CC) pins in the connector, created by resistors at each end of the cable to indicate the electrical current level expected. When the device sees a 56kohm pull-up resistor, it recognises a legacy cable connection, negotiates a lower charge rate and everybody's happy. However, Leung has apparently found numerous cases where this resistor is either

missing or has the wrong value, making the cable or adapter non-compliant. The result is the device thinks the legacy charging port is Type-C-compliant and attempts to start sucking out 3.0 amps of current from the power source. Not good. To learn more, read Benson's Google+ posts at tinyurl.com/qdcccjdq.

The clear message here is make sure you purchase compliant cables and adapters, otherwise you may end up with a trail of dead legacy USB chargers and ports behind you.

If you have a 2015-class Chromebook Pixel notebook, you can test your own USB Type-C legacy cables to find if they're within specification. Launch a Terminal prompt and type:

```
ectool --name=cros_pd
usbpdpower 0
```

According to Leung, if the cable has a Type-A connector on the other end and you get a response such as:

```
Port 0: SNK Charger Type-C
5147mV / 3000mA, max 5000mV /
3000mA / 15000mW
```

It implies a 3000mA (3.0-amp) charge rate and is non-compliant (tinyurl.com/qf8nvms).

FAST, RAPID OR QUICK CHARGE?

USB 3.1 also comes at a time when the device battery charging market is full of similar-sounding options such as 'fast charge', 'rapid charge' and 'quick charge'.

The term 'Fast Charge' got early use as a combined Android kernel/USB cable hack, designed to con the mobile device being charged into thinking it's plugged into an AC USB charger, when it's actually plugged into a PC USB port. The idea is to hack faster charge speeds, despite inherent dangers to the USB port. However, you also see 'Fast Charge' as a short-hand to describe standard Type-C high-speed charging.

A more involved, but USB-independent solution is 'Quick Charge' from ARM chipmaker Qualcomm. It's built into most late-model Qualcomm Snapdragon chips, offering faster charging than current USB standards. It's also available as a standalone controller chip from specialist foundries such as OnSemi (tinyurl.com/qfadaql, PDF) for use in other Quick Charge-licensed phones.

HOW FAST CHARGE WORKS

Lithium-polymer batteries have a physical limit on how fast you can pump electricity into them, but that limit exists alongside current USB charge rates. However, there's another issue affecting charge times that Fast Charge aims to overcome — the USB

cables themselves. Most USB cables are very thin and when you consider there are four separate conducting wires within each cable, the diameter of those separate wires starts getting very small indeed. Thin cables are lighter to carry and cheaper to make, but they're a real problem for high-speed charging because thinner wire has a more limited ability to carry electrical current.

With thinner wire, you have greater resistance per length and that creates two main problems. First, increased cable resistance at a fixed voltage reduces the current flow to the device for battery charging. Ohm's Law, "current = voltage/resistance", strikes again, and put simply, if you fix the voltage and increase the resistance, you reduce the current.

But additionally for USB, the increased cable resistance results in a voltage drop at the device-end. This can trick the device being charged into thinking the power source can't supply sufficient current, triggering charge-fault conditions within the phone or renegotiation of the charge rate to a lower level to maintain the required USB voltage.

Quick Charge 2.0 and similar tech overcome these problems by allowing the use of higher voltages, so instead of the normal 5VDC, a Quick Charge 2.0 or

later system can use 9VDC or 12VDC over USB with corresponding lower current levels to maintain the same power transfer. The benefit is greater efficiency and lower cable losses.

The new Quick Charge 3.0 system uses INOV, Intelligent Negotiation for Optimum Voltage, setting the USB voltage anywhere between 3.2VDC and 20VDC in 0.2V increments for maximum efficiency.

FASTER BY HOW MUCH?

Quick Charge version 1.0 claimed to deliver a 30% charge to a 3300mAh battery in 30 minutes, compared with a standard 5VDC/1-amp USB charger that managed a 12% charge over the same time to the same battery. With Quick Charge 2.0, the charge rate went from 0% to 60% in that 30-minute period on the same battery.

New Quick Charge 3.0 provides the same charge speed as version 2.0, but does it with 38% greater efficiency. However, like Type-C and the new Power Delivery 2.0 spec, Quick Charge is designed to work with previous USB standards — you just need a Quick Charge-ready phone and Quick Charge-ready AC charger for it to work.

QUICK CHARGE ALTERNATIVES

Qualcomm's technology is being picked up by various phone makers, who

market it under their own branding. For example, HTC sells 'Rapid Charge', Motorola 'Turbo Charge' and yet both are fundamentally Qualcomm Quick Charge tech. Unfortunately, we've also seen these terms used interchangeably with Type-C high-speed charging, adding to the confusion.

Samsung's version of Quick Charge is 'Adaptive Fast Charging'. The company includes an Adaptive Fast Charger with the Galaxy S6 and S6 Edge, with reports suggesting it delivers a 25% charge to the S6 battery in just 15 minutes and near-on 75% charge in 40 minutes (tinyurl.com/q61zj2q).

SNAPDRAGON QUICK CHARGE CHIPS

Quick Charge 2.0 already exists in a number of current Qualcomm-powered Android phones and tablets, including the HTC One M9, Google's Nexus 6, the LG G Flex2 and G4 phones and Sony's Xperia Z4 tablet. It comes built into current-generation Snapdragon 805, 808 and 810 SoCs, while Quick Charge 3.0 will appear as part of next-generation octa-core Snapdragon 430, 617 and 620 chips, the six-core Snapdragon 618 and new four-core Kryo-powered Snapdragon 820 SoC.

NEXUS 5X OF NO-SHOW?

Of course, there are always exceptions to any rule, one of them being Google's LG-made Nexus 5X. It's built around the Snapdragon 808 SoC, has a Type-C connector and teardown reports appear to confirm it having Quick Charge 2.0 hardware inside — except, it doesn't support Quick Charge. Just why it hasn't been activated isn't clear, although it might possibly be enabled later, similar to Wi-Fi connectivity on Android Wear watches earlier this year. Still, with Type-C connectivity, the Nexus 5X already implements 5V/3-amp charging (even though it's only USB2.0 for data, as we mentioned earlier), so who knows.

"Ohm's Law strikes again. If you fix the voltage and increase the resistance, you reduce the current."



Check the AC charger for which Quick Charge standard it supports.

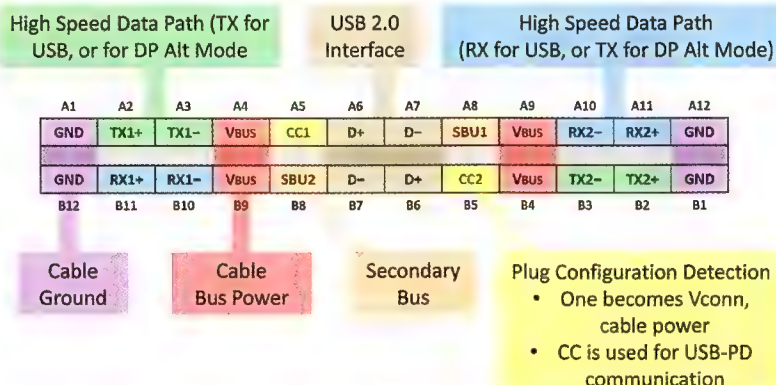


Qualcomm chips support differing Quick Charge standards — check for yours.

USB Type-C Receptacle Pins

Pins defined for system or device receptacle

New Type-C connectors have dedicated USB2.0 data pins for legacy use.



VESA Confidential



The Galaxy S6/S6 Edge handle Adaptive Fast Charging (Quick Charge).

GETTING BETTER BATTERY LIFE

Take a look at almost any mobile OS update release and, within a day or two, the first gripe from users is almost always "poor battery life". Android began its recent power management crusade back with Lollipop's Project Volta and here in Marshmallow, Google follows up with two new power modes – Doze and App Standby.

Doze is like Windows' sleep mode, but instead of hibernating for the winter when the user puts the device down with the

screen off, it allows the device to wake up intermittently to sync apps and perform maintenance operations. Essentially, Doze mode locks network access, alarms from the AlarmManager are delayed until the next regular wake-up maintenance period, no Wi-Fi scans are performed and there's no syncing or job scheduling.

App Standby takes power management a step further. Because Android is designed to keep as many apps in memory as the device can handle, there's always the possibility that an app, even if not being actively used, could grab the network and

decide to update or just sync in the background, not just chewing up data, but battery life as well.

Instead, App Standby keeps track of when a user last used an app – after a set period, Android determines that app has gone into 'standby mode', disabling network and sync access.

Google is advising developers writing apps using the AlarmManager and targeting API Level 23 to check those apps still perform as expected on Marshmallow. The new OS includes two new methods for this – `setAndAllowWhileIdle()` and `setExactAndAllowWhileIdle()`, but according to Google's Android Developer website, you're only allowed to fire these off once every 15 minutes per app (tinyurl.com/pu6e8oe).

CHOOSE CAREFULLY

With so many standards requiring backward compatibility, you're still only looking at a small subset of all connection permutations available giving you full accelerated charge rates. Throw in devices that have Quick Charge hardware but the functionality disabled, Type-C cables and adapters out-of-spec, competing charging standards and this whole "high-speed charging" caper still needs work.

If you build a complete Quick Charge chain, the results look exceptionally good at the moment. But bottom line, unless a device specifically says it conforms to a particular fast-charging methodology, it seems safer to assume it doesn't conform to any of them. ■



Claims are not all Type-C legacy cables meet USB standards.

Arduino Wi-Fi, Part 3 — Getting high

A tiny sensor inside the Galaxy S4 smartphone measures altitude from below sea-level up into space. Darren Yates shows how to use it with a Wi-Fi-connected Arduino Uno.

Smartphones are jam-packed with sensors — everything from gyroscopes to accelerometers to magnetometers. They can even measure barometric pressure.

If you're into weather observations (like I am), the three key environmental parameters you want to record are temperature, relative humidity and barometric pressure.

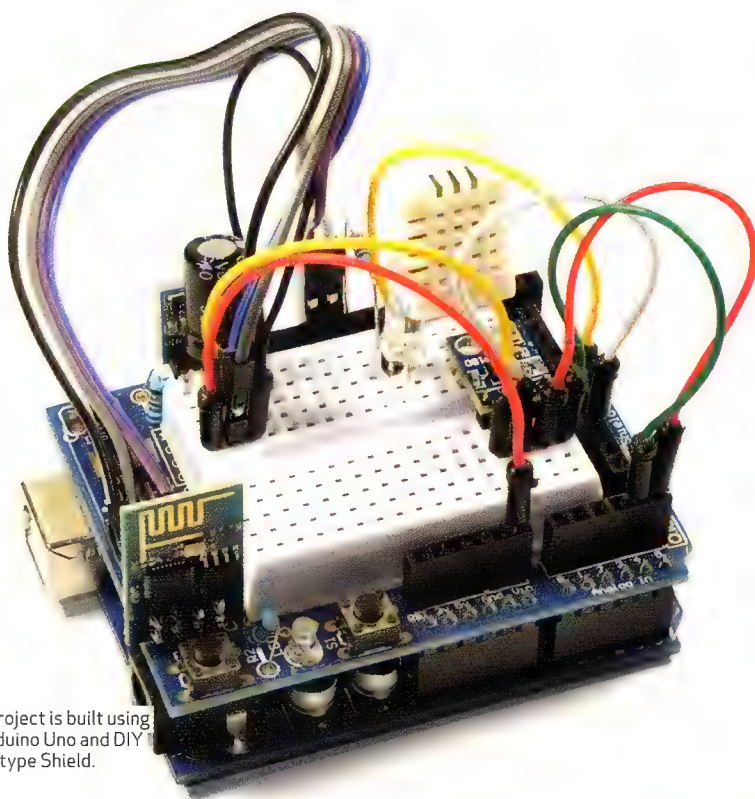
New digital pressure sensors hitting the market are so accurate, your phone can even measure elevation with accuracy to within 17cm up to an altitude of 9km. What's even more awesome, you can buy these sensors and add them to an Arduino.

WI-FI WEATHER

Last month, we created a simple Wi-Fi Weather Station with an Arduino Uno, DHT22 environment sensor and ESP8266 802.11n Wi-Fi module, readable from any browser on your home network. Now, we're adding a digital pressure sensor you can buy online for under \$5. This is no dinky 'hobby' sensor, however — it's a commercial-grade sensor with accuracy I mentioned earlier. The BMP180 is made by German industrial giant Bosch, who know a thing or two about putting pressure sensors into phones — Samsung chose this exact sensor for 60-odd million Galaxy S4 smartphones.

SENSOR MODULE

The BMP180 is available as a four- or five-pin module with the standard 0.1-inch pin pitch. It only needs four connections: Vcc (3.3V), GND (0V), SCL (serial bus clock input), SDA (serial bus data output). The module is tiny, the size of a MicroSD card, but the sensor itself is not much more than a breadcrumb at 3mm x 3mm. The only trick with this module is you must power the Vcc pin with 3.3VDC, not 5VDC, otherwise, you'll blow it up. The SCL and SDA lines are 5VDC-tolerant, thanks to internal pull-up resistors. Connect up the power connections, point the SDA pin to

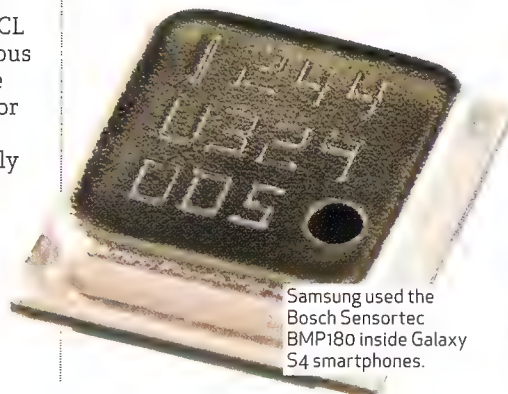


The project is built using an Arduino Uno and DIY Prototype Shield.

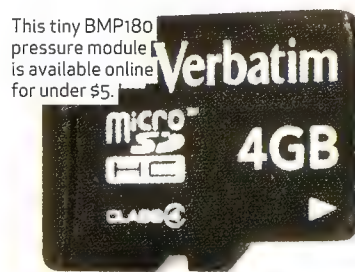
Arduino pin A4, the SCL pin to Arduino pin A5 and you're done. Follow the overlay diagram and pics to build your own version using an Arduino Uno and the small DIY prototype shield.

SOURCE CODE & LIBRARIES

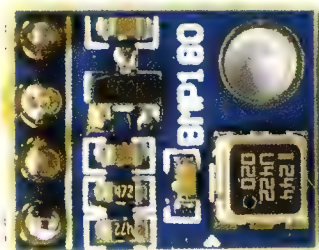
You also need a code library to link the BMP180 into the Arduino IDE and, thankfully, there are



Samsung used the Bosch Sensortec BMP180 inside Galaxy S4 smartphones.



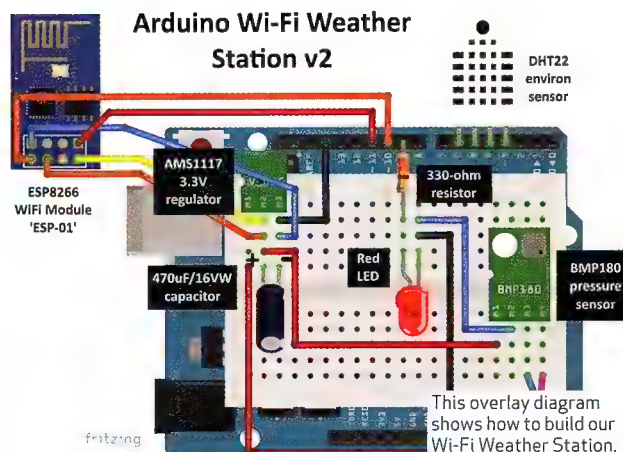
This tiny BMP180 pressure module is available online for under \$5.



$$\text{altitude} = 44330 * \left(1 - \left(\frac{p}{p_0} \right)^{\frac{1}{5.255}} \right)$$

The formula for calculating altitude from relative air pressure readings.

"To get accurate readings, you need to know your location elevation above sea level."

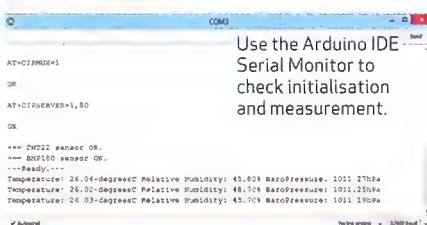
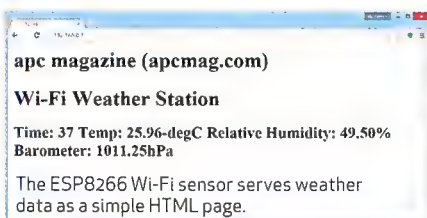


several available online. We've chosen the Sparkfun library because it's small and as easy to use as these things can be. Grab our source code from the APC website (www.apcmag.com/magstuff), unzip the archive and copy the contents of the libraries subfolder into the same of your Arduino IDE. If the IDE is already running, close all instances and restart it so the new libraries will take effect.

There are two key libraries – the SFE_BMP180 library and the Arduino Wire library. The SFE_BMP180 library directly handles the pressure sensor, but the Wire library is a special library included with the Arduino IDE for handling I2C communications.

INTER-INTEGRATED CIRCUIT

Long before USB came along, Philips developed a low-power serial bus called I2C for this very task – connecting low-power digital components together. Intel's old System Management Bus (SMBus) is based on I2C. Arduino doesn't have an I2C bus itself, so the Wire Library creates a virtual one using pins A4 and A5 (these are normally analog input pins, but they can also be configured as digital I/O, as we'll see here).



MEASURING ALTITUDE FROM AIR PRESSURE?

In normal atmosphere, the fall in air pressure as you rise in altitude can be calculated by mathematical formula. Here, 'p' represents the pressure measured by the digital sensor in SI units called hectopascals (hPa or 100 Pascals) and 'p0' is the air pressure at sea level, which is defined as 1013.25hPa. We've shown the formula here, but put simply, a fall of 1hPa equals a rise in altitude of 8.43 metres at sea level. You can read more about this from the Bosch Sensortec BMP180 datasheet (tinyurl.com/pxcdgnw, PDF, page 16).

HOW IT WORKS

To code this into our Wi-Fi Weather Station, we'll just look at the code to make the BMP180 work. The first thing we do is create an SFE_BMP180 data object imaginatively called 'BMP180'. When barometric pressure is shown on synoptic charts in nightly news weather reports on TV, that pressure is scaled relative to sea-level. Since pressure changes with altitude, scaling relative to sea-level takes out altitude as a factor in the measurements, ensuring any change in pressure is due to weather conditions alone.

That means to get accurate readings, you need to know your location elevation above sea-level. In Australia, town elevations are usually based on the local Post Office or Automatic Weather Station (AWS). The Bureau of Meteorology has a decent list of GPS coordinates and elevation for many Australian towns (tinyurl.com/nc9p3a7).

We've put all of this gory detail into a simplified function called `getPressure()`. To get an accurate pressure reading, the sensor must first take the current temperature (`BMP180.startTemperature()`). Once that

reading is recorded in variable 'tempC', the pressure reading is then taken (`BMP180.startPressure()`). The '3' parameter tells the sensor to capture using maximum oversampling to reduce atmosphere noise and increase accuracy. When that's completed, the `BMP180.getPressure` function uses the temperature to get the absolute pressure level, stored in the 'pressureCurrent' variable.

Finally, the `BMP180.sealevel` function takes that absolute pressure reading, along with the current altitude and converts it to a relative-to-sea-level reading, storing the result in the `BMPbar` variable.

POSTING TO YOUR NETWORK

From last month, the ESP8266 is coded to send HTML code when it receives a client request to its virtual access point IP address. Here, we just add the new Barometer readings from the `BMPbar` variable into the 'webpage' string variable holding all of the HTML code. The code displays temperature, relative humidity and barometric pressure relative to sea level.

All you need now is a few hundred of these projects around the country and you have your own weather service.

LEARN ABOUT YOUR ENVIRONMENT

Seriously, though, this project is a great way to learn about sensors, Wi-Fi and the environment. You can power it off-grid using a phone Power Bank and with modifications, change the record period and store the results to MicroSD card. From there, you can do some basic data analysis and learn the relationship between these three weather factors.

The ESP8266 Wi-Fi module we've been looking at over the last couple of months is the perfect tool for this kind of application. It's easy to use, incredibly low-cost and small enough to hide in almost anything. ■

Building GUI apps faster

You can build a graphical user interface manually, but it doesn't hurt to learn to use a GUI builder. Darren Yates shows how with NetBeans.

Last time, we looked at the fundamentals of Java's graphical user interface (GUI) armoury, its Layout Managers and explored the three basic options: BorderLayout, FlowLayout and GridLayout. But hand-coding isn't the only way to build GUI designs. Most of the major IDEs now support drag-and-drop style GUI builders – NetBeans comes with Swing GUI Builder, while Eclipse now has a plug-in option called WindowBuilder. But as we've been using NetBeans exclusively through this series, we thought that, this month, we'd take a look at how GUI Builder works and compares with a practical example.

CREATE A NEW PROJECT

Our project last month was a Mortgage Calculator, in which, we created the GUI from scratch by hand. It's a pretty simple app as far as GUIs go, but it provides the perfect baseline to compare building the same interface using the GUI Builder.

To start, fire up NetBeans and from the main menu, select File > New Project. On the New Projects window, you should see "Java" highlighted in the Categories list and "Java Application" in the Projects list. If not, make any necessary changes. Otherwise, press Next. On the New Java Application window, change the Project Name entry to something appropriate (we've used "MortgageCalc2") and un-tick the checkbox next to "Create Main Class". Now press Finish.

After project initialisation is completed, right-click on the project root folder and select New, JFrame Form from the context menus. On the New JFrame Form window, change the Class Name and Package entries (we've used "NewInterface" and "apcmortgagecalc2", respectively). You can use whatever you think is appropriate, but we suggest using capitals for former and lowercase for the latter. When you're done, press the Finish button.

GUI DESIGNER WINDOW

As soon as you do that, NetBeans will open up the IDE with the GUI Builder window. Depending on if and how you've modified the IDE layout, you should have four area sections – the Navigator window down the left side, the design window upper-middle, the

Date	Payment	Amount Interest	Amount Principal	Current Balance
26-11-2015				500000.00
10-12-2015	1315.66	913.46	402.19	499597.81
24-12-2015	1315.66	912.73	402.93	499194.88
7-1-2016	1315.66	911.99	403.66	498791.21
21-1-2016	1315.66	911.25	404.40	498386.81
4-2-2016	1315.66	910.51	405.14	497981.67
18-2-2016	1315.66	909.77	405.88	497575.79
3-3-2016	1315.66	909.03	406.62	497169.17
17-3-2016	1315.66	908.29	407.37	496761.80
31-3-2016	1315.66	907.55	408.11	496353.69
14-4-2016	1315.66	906.80	408.86	495944.83
28-4-2016	1315.66	906.05	409.60	495535.23

jLabel10 jTextField7
jLabel11 jTextField8
jLabel12 jTextField9

GUI Builder will snap to alignment guidelines to give you a clean design.

runtime output box below and the Swing and AWT GUI component palette down the right-hand side.

You'll also see a second toolbar row at the top of the design frame, showing Source, Design and History buttons. To the right of those buttons, the first two icon buttons toggle between selection and connection mode, while the third is a preview button. This gives you a centre-screen preview of what your GUI design will look like, but be aware, it's a quick preview and uses the default OS system theme, or "look and feel" (LaF) as Java calls it. When you actually come to run the app, the user interface will feature Java's default Nimbus LaF (tinyurl.com/q3jouwj) provided you're using the default setup. To see Nimbus LaF in preview mode, head to the Navigator window, right-click on the

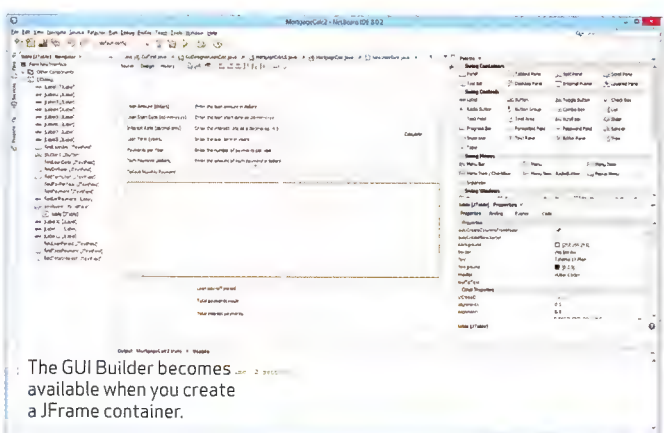
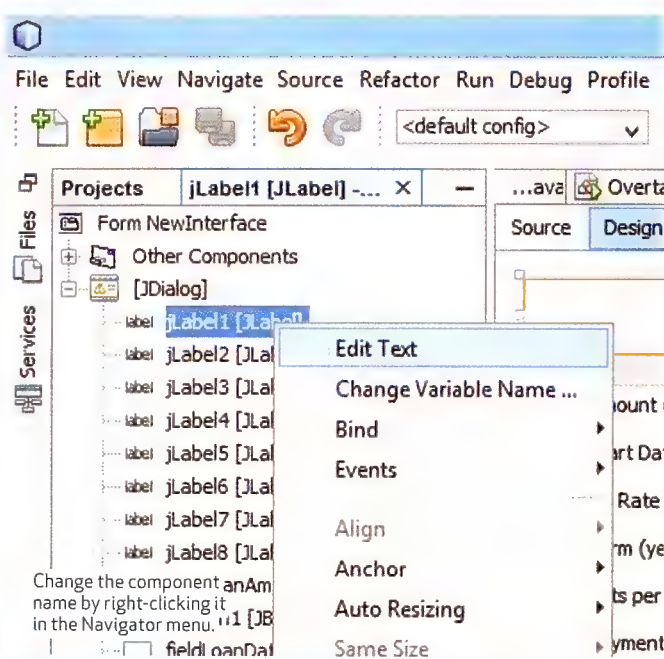
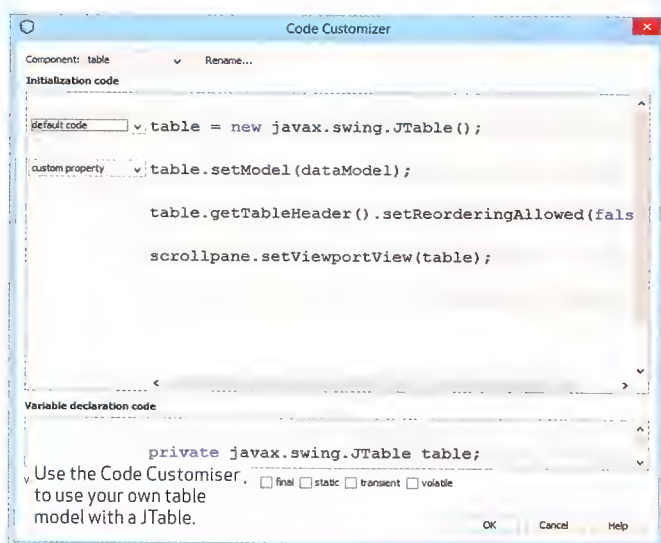
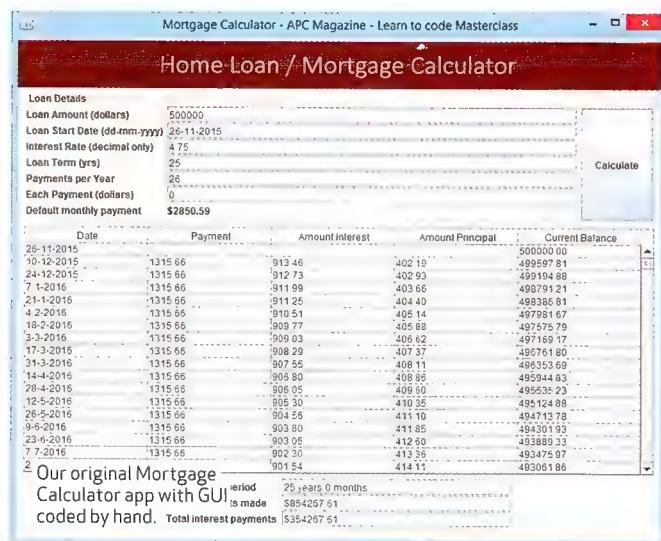
"[JDialog]" entry, select Preview Design and choose Nimbus from the context menu (feel free to try any other options as well).

DRAW AND DROP

To start building up your user interface, click on a component from the palette and drag it onto the JFrame. If you were with us last month, you might remember that each of the Layout Manager options uses auto-placement (within reason) and auto-arranges components should you change the size of the frame.

The GUI Builder on the other hand uses the newer GroupLayout manager, which basically locks a component's position to wherever you drop it, although if you resize the JFrame, GUI components on the right-side will expand to fill the space.

But to help you create a clean design where components line up and are positioned with regular spacing, the GUI Builder will also offer you automatic alignment guideline suggestions to snap your components to. You set the location of the first component and GUI Builder will use that to baseline its future suggestions as you near that original component with your next. Bottom line,



for simple layouts like our Mortgage Calculator app, it means a GUI layout can be completed in a fraction of the time it takes to build by hand.

To complete the app GUI, we'll start by loading up the JLabel and JTextField components into the JFrame, followed by a JButton. Underneath, we add a full-width JTable and JScrollPane. Finally, we add in three more JLabels and JTextFields.

CLICK AND DRAG

Once you've added a new component to the JFrame, you can resize it by simply clicking one of the eight corner/side handles and dragging it to change its size. Pull the component towards the edge of the JFrame and you'll see the alignment guidelines – these allow you to create a clean, uniform look.

GUI Builder also provides a bucketload of short-cut options. For example, with JLabels, double-click on the component to activate label editing and you can change the text on the spot. However, for all text-based components, you can also just right-click on the component and choose Edit Text from top of the context menu.

COMPONENT PROPERTIES

There's one other section of the default GUI Builder frame in NetBeans – the Properties window. If you can't see it, it's probably a tab to the right of the Palette window, running down the far-right border. Click-and-drag that tab into the main IDE window and you can add it permanently to the GUI Builder frame.

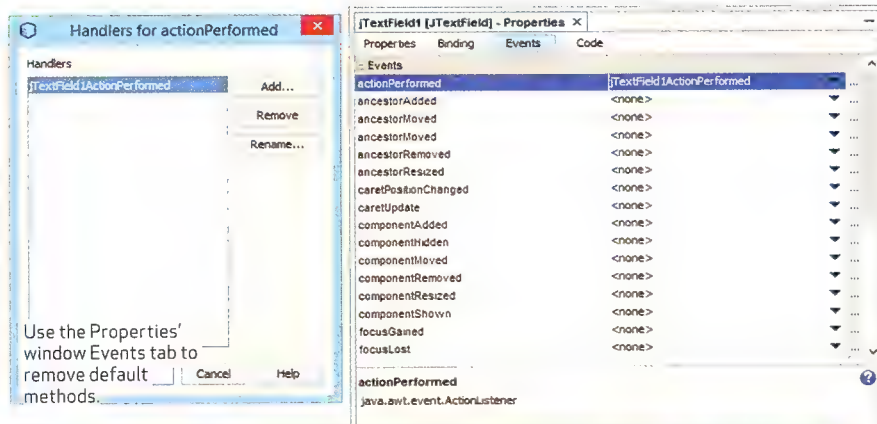
As you click on each GUI component, the Properties window displays that component's properties in four group options: Properties, Binding, Events and Code. They allow you to change how the component looks, (foreground/background colours, font type, style, size etc), but also how it interacts with other variables, other events and most steps in between.

GUI BUILDER SHORTCUTS

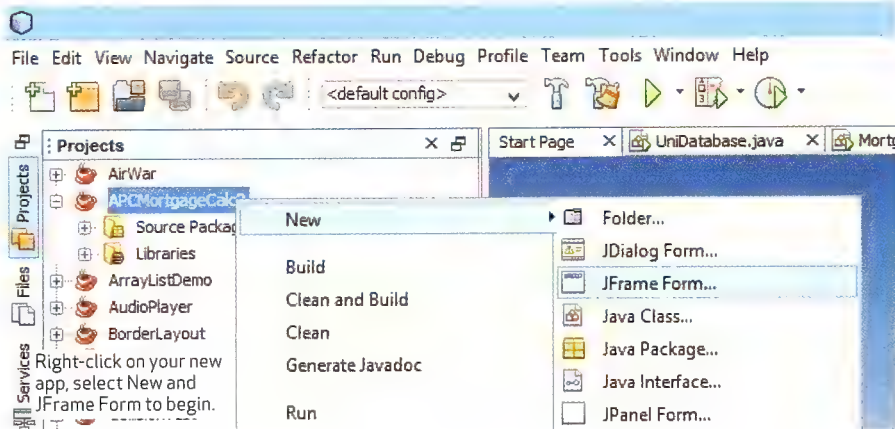
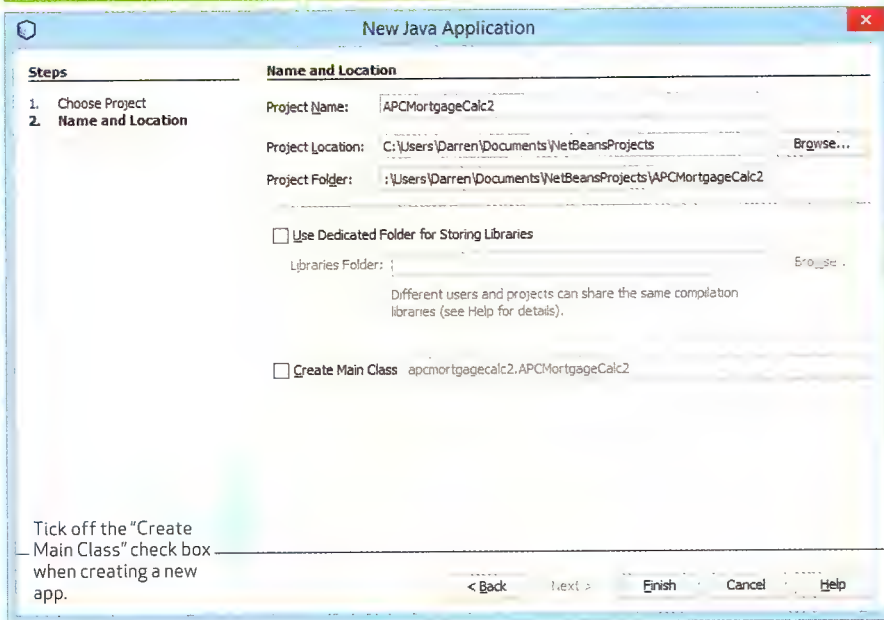
Another thing you'll want to do quick-sticks is change the default names NetBeans gives your GUI components. The fact NetBeans automatically names them gives you one less thing to do if you're in a hurry to create your design, but names like "jTextField1", "jTextField2" and so on aren't terribly

Get NetBeans, Java & source code

To follow along, download the NetBeans IDE and Java SE SDK bundle from Oracle's website (tinyurl.com/nqnuxfp). Alternatively, you can install them separately, but just make sure you install the Java SE SDK first as NetBeans will look for it during installation. Download the source code for this project from our website (www.apcmag.com/magstuff) and compare how it works with last month's version. Unzip the downloaded zip file and on NetBeans, select File > Import Project > From ZIP and choose the inner zip file from the unzipped download. NetBeans will do the rest.



"When I was a kid, we couldn't wait to get our hands on a calculator, so we could rip through our homework and do something more enjoyable. Thankfully, we weren't allowed anywhere near one until we'd learn how to do mathematical calculations by hand."



descriptive, particularly when, later, you're trying to remember what their roles are in your code.

Click anywhere in your design window and the Navigator window on the left will give you a full list of all the GUI components in your design. Right-click on any component in the list, choose Change Variable Name and you can change the component name to something more useful.

REMOVING ACTIONPERFORMED METHODS

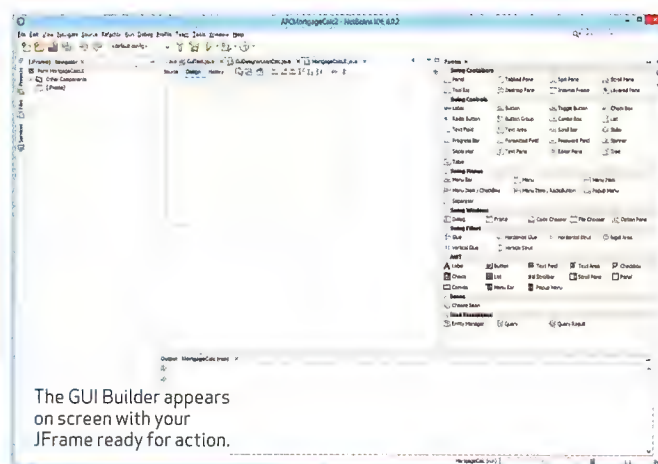
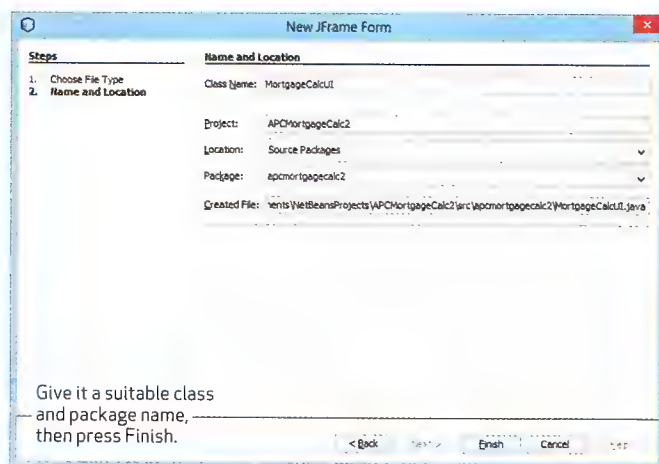
Double-clicking on a user-action component such as a JTextField or JButton in the design window will automatically create an "ActionPerformed" method in your source code and take you to it. It's an easy way to start building the activity functionality into your GUI and linking it to your code. The only problem with it is once the method has been created, getting rid of it can be a bit tricky.

In fact, the only way to delete these auto-generated methods in the most recent releases of NetBeans is to go back to the design window and click on the GUI component whose method you want to delete. Next, go to the Properties window, click on the Event tab button and you should see ActionPerformed at the top of the Event list with a link to the method you want to remove. Go to the end of this row, click on the ellipsis (...) button and this brings up the Handlers window. Click on the ActionPerformed handler in the new window and press the Remove button. Now go back to your source code and the offending method should have disappeared.

BINDING DATA MODEL TO JTABLE

You may also remember from last month that, in order to get our mortgage payment schedule data to appear in the JTable, we created a TableModel, bound that to the JTable and put the JTable inside a JScrollPane to allow scrolling beyond the visible window. Then as we created the schedule data, we added it row by row to the TableModel (which we called "dataModel").

But when you add a JTable via the GUI Builder, the Builder creates the new instance, but also creates its own table model. For many applications, having this done automatically for you helps speed up coding. But if you want to use a custom TableModel, you have to tell the GUI Builder to back off its auto-gen code to allow yours to work. To do this, you must right-click on the JTable in the left-side Navigator window and select Customise Code from the context menu. In the Initialisation Code window, look for the "table.setModel" codeline, change the dropdown on the left from "default code" to "custom property" and inside the braces, type in the name of



your `TableModel` you want bound to this table (here, our `TableModel` is `"dataModel"`). Click the OK button.

If you look at the `NewInterface` class in the source code, we manually add five columns to the `dataModel` object, one each for `Date`, `Payment`, `Amount`, `Interest`, `Amount Principal`, `Current Balance`. These initialise the columns and provide the column headers at the same time. Without them, no payment schedule data will be displayed in the table.

LAUNCH THE APP

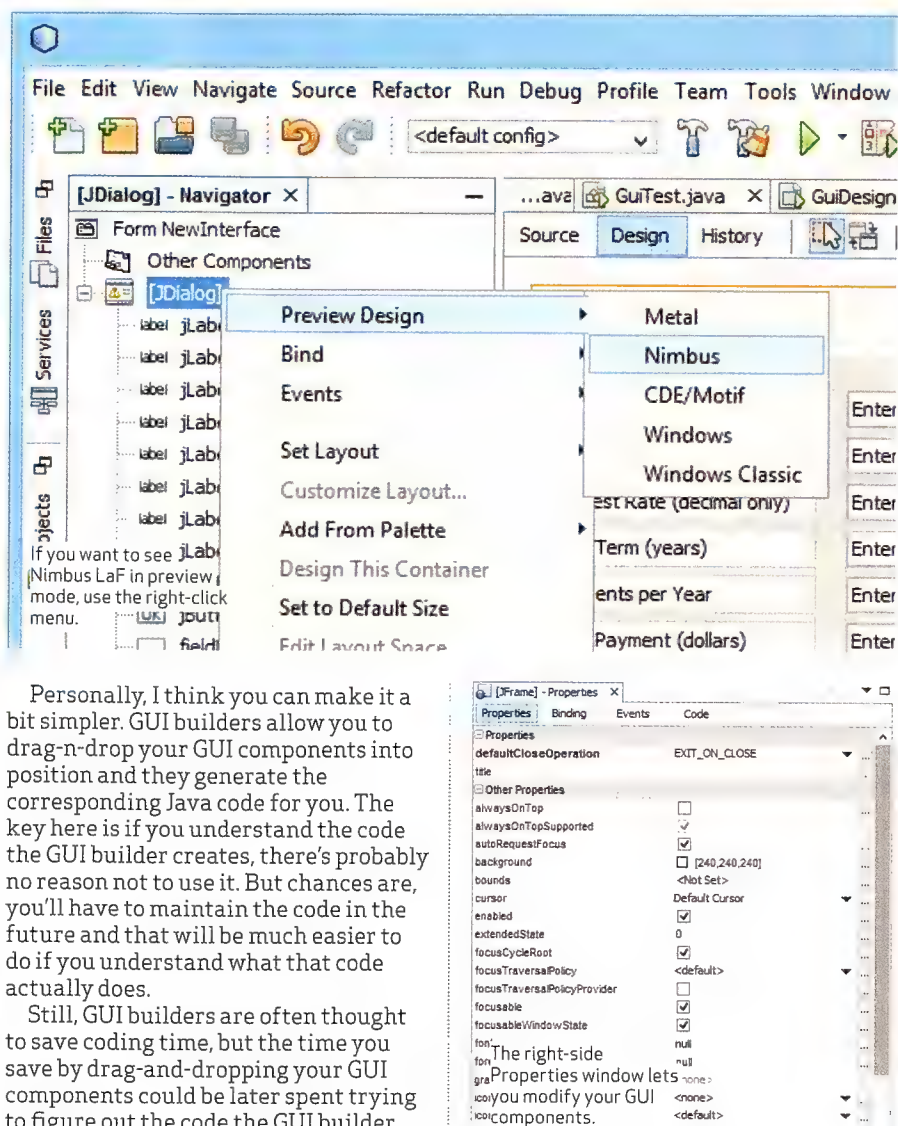
Run the app, compare it with last month's version and it should perform almost identically. You'll also see that we've brought over the two main engine room methods, `calculateLoan()` and `getStartDate()` — there's no need to reinvent the wheel if we don't need to.

SO HAND-CODE OR GUI BUILDER?

This is one of the most common questions around this topic – should I hand-code my GUI designs or use a GUI builder framework instead? In a way, there are two issues here – using a GUI builder to save from having to learn how to hand-code plus the suitability of GUI builders for every app.

When I was a kid, we couldn't wait to get our hands on a calculator, so we could rip through our homework and do something more enjoyable. Thankfully, we weren't allowed anywhere near one until we'd learn how to do mathematical calculations by hand. The moral behind that analogy fits here as well — GUI builders can save time, but knowing how to hand-code a GUI should help you make better use of GUI builders, by understanding how basic Java GUI design works.

But using a GUI builder for every app? This one depends on who you talk to. Some developers won't touch GUI builders and prefer to do every job by hand, others will say life's too short, there's too much to learn, so cut corners whenever possible. Still others again are more pragmatic, choosing on a case-by-case basis.



Personally, I think you can make it a bit simpler. GUI builders allow you to drag-n-drop your GUI components into position and they generate the corresponding Java code for you. The key here is if you understand the code the GUI builder creates, there's probably no reason not to use it. But chances are, you'll have to maintain the code in the future and that will be much easier to do if you understand what that code actually does.

Still, GUI builders are often thought to save coding time, but the time you save by drag-and-dropping your GUI components could be later spent trying to figure out the code the GUI builder just generated. Why? Look at the number of code lines for the two versions of our Mortgage Calculator — the hand-coded version is 210; the GUI Builder version is 400 — and 201 lines of that comes from the GUI Builder itself. My experience is that using GUI designers almost always create more code than hand-coding the GUI yourself.

Let's say you need to come up with a simple GUI design fast for a meeting to get a project off the ground. In that case,

something like NetBean's GUI Builder is a no-brainer. But it's just worth remembering that wandering through the GUI code may well take you longer than code you've created yourself.

That's why I'm a fan of learning how to create GUI apps both ways. There might be short-cuts to coding, but there are no short-cuts to learning and the more you learn, the better a coder you'll be. ■



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Fallout 4

War never changes... and neither does Bethesda's *Fallout*.

Bethesda knows this and has delivered a wonderfully familiar RPG adventure through the irradiated wastes, with just enough tweaks and changes to the formula to deserve notching a full version number after the title. Though at times, you could squint and swear it was 2008 again... sometimes, that comfortable familiarity is all you need.

Set in Boston, *Fallout 4* opens shortly before the bombs drop, when everything is in its curvy, shiny 1950s-inspired prime. It also essentially serves as an extended character-creation screen where you can choose your gender and laboriously sculpt the face of your wastelander (that you'll no doubt cover with a mask and never see again). Thankfully, the bombs drop in fairly short order and your happy little family legs-it to a cryogenic vault, waking only to witness your spouse get killed and your son Shaun taken.

In *Fallout 3*, you were looking for your father; in *New Vegas*, the guy who shot you in the face – both great goals and loose enough motivations to make taking

the time to scavenge and help out the people of the wastes not feel like you were neglecting the main story. This time, however, there's such a sense of urgency created that it feels a little strange to almost immediately change tack and help a settler clear out a gang of raiders from the local power plant, scour long deserted buildings in search of glue, screws or nuclear material (which you'll be wasting a lot of time doing if you want to tackle the vastly expanded crafting or new settlement systems) or just taking care of business for one of the four major factions in post-apocalyptic Boston.

Crafting has been a limited feature of the *Fallout* series since Bethesda took over the franchise – and gels nicely with the idea of tenuous survival in the wastes – and that system has now blown out to include extensive weapon and armour mods. If you've scavenged enough of the requisite components – glue, lead, screws and so on – which can be found by breaking-down objects around the world, you can improve weapons, strengthen armour and modify your power armour sets. It does

become a little cookie cutter, in that the ideal loadout is often silenced weapons with maximum damage output, but there's enough variety there for anyone looking to experiment with their boomsticks.

Power armour also has plenty of options for upgrades – including a jetpack at the upper end – and unlike previous games, there's no restrictions on the latter's access and use. In fact, you'll more than likely end up with seven or eight complete sets by the time the credits roll. Power armour is totally optional to use, and we found we didn't really need it until the difficulty was pushed up to survival.

Equally, we found the series' signature VATS combat mode optional, as the live shooting mechanics are fantastic. Guns feel meaty and purposeful and combat can be desperate and chaotic – so much so that jumping into the latest *Call of Duty* feels weightless and shallow by comparison... business as usual for *CoD*, we guess.

Even bumping into a pack of relatively harmless feral ghouls is terrifying, as they sprint toward you and leap for a full body slam. You learn

pretty early on to aim for the knees to disable them – an essential life-lesson borrowed from the *Dead Space* series.

Base building and micro-management is an optional side-game in *Fallout 4* – we should have seen it coming with the *Fallout Shelter* mobile app. It lets you work alongside settlers to build and develop complex townships, again with scavenged materials. Pieces and building blocks snap together kind of like LEGO, then you just add power and lights and, in no time, you've got 12 settlers moving into your shanty-town looking to be fed and housed.

Fallout 4's not going to win awards for its looks. It's a game that definitely shines on the PC – and is the prettiest *Fallout* game – though it looks shabby when held up to recent, technically brilliant titles like *The Witcher 3*. Still, the game's blasted wasteland is undeniably an immensely enjoyable way to waste a few hundred hours.

■ Troy Coleman

Verdict

A classically great RPG with tweaked shooter mechanics, expansive crafting and base-building systems.

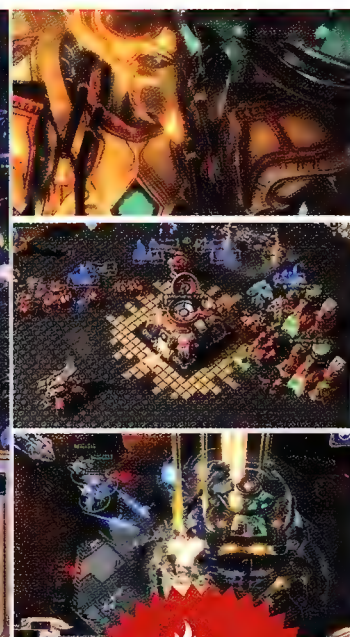




FROM \$54.95 | PC | WWW.BATTLE.NET

StarCraft II: Legacy of the Void

Brings a 17-year epic to a fitting close.



StarCraft's competitive element has become the thing it is best known for over the course of the series' long life. That makes sense: it's the original stadium-filling eSport and one of the most skill-intensive games ever made. For the long-term fans who know StarCraft primarily in this regard, *Legacy* marks the start of the game's new era.

It's a suite of new units, features and balance changes that will define the character of the game for the next couple of years.

From my position of limited skill, I can tell you that *Legacy of the Void*'s changes make the competitive game faster, more skill-intensive and less fiddly. There's a greater emphasis on making big decisions early. You begin your match with more worker units than before, and the business of setting up your economy has been streamlined. Fights happen faster and, as a consequence, matches are shorter. You might get caught out by a rush strategy you didn't see coming: you type 'GG', surrender, tab out to

TeamLiquid, read up on your counters, tab back, and you're playing again within a minute. It is easier than ever to lose evenings to the ladder in this way.

That elevated skill ceiling is a consequence of new units that become dramatically more powerful if you're capable of micromanaging them effectively. One example is the Protoss Adept, a ranged infantry unit that can act as an alternative to Stalkers and Zealots. In and of itself, the Adept is capable enough, but its real power comes from Psionic Transfer, which creates a ghostly duplicate of the Adept that is controlled separately. These doppelgangers are invulnerable, and after seven seconds, the Adept teleports to the ghost's location. Suddenly, new strategic pathways open: around entrenched positions and into worker lines, past the enemy's own targeted abilities and (hopefully) into victories that go beyond cheesing and strict counters.

Legacy of the Void wholeheartedly supports the notion that *StarCraft* is a difficult game and that player skill should be

respected. The reason *Legacy of the Void* comes highly recommended, however, is that it also supports the idea that you should be able to have fun regardless of how good you are.

As in *Wings of Liberty* and *Heart of the Swarm*, Blizzard treat singleplayer as its own entity, with its own units and rules. The final part of the trilogy tasks you with uniting the fragmented factions of the Protoss race from aboard an ancient warship, the Spear of Adun.

After over five years of *StarCraft II*, the new missions don't manage to feel quite as fresh or original as *Wings of Liberty*'s did when it came out. You will track down and destroy three different objectives while also hunting for two or three different optional objectives on several worlds and in several different contexts, albeit with new units and powers to prevent each encounter from feeling exactly the same as the last.

The core Protoss campaign is the shortest of the series so far, but it's bookended by mini-campaigns that, collectively, amount to a substantial and largely

gratifying conclusion to the series. The nebulous cosmic threat spoken of in cutscenes from *Brood War* onwards finally arrives, and is dealt with not just by the Protoss but by the Terran and Zerg characters that you've come to know as well. Raynor and Kerrigan get their ending, as do Zeratul, Artanis and all of the other Protoss who (if you're me) you've probably confused with each other over the almost two decades that Blizzard has been telling this story.

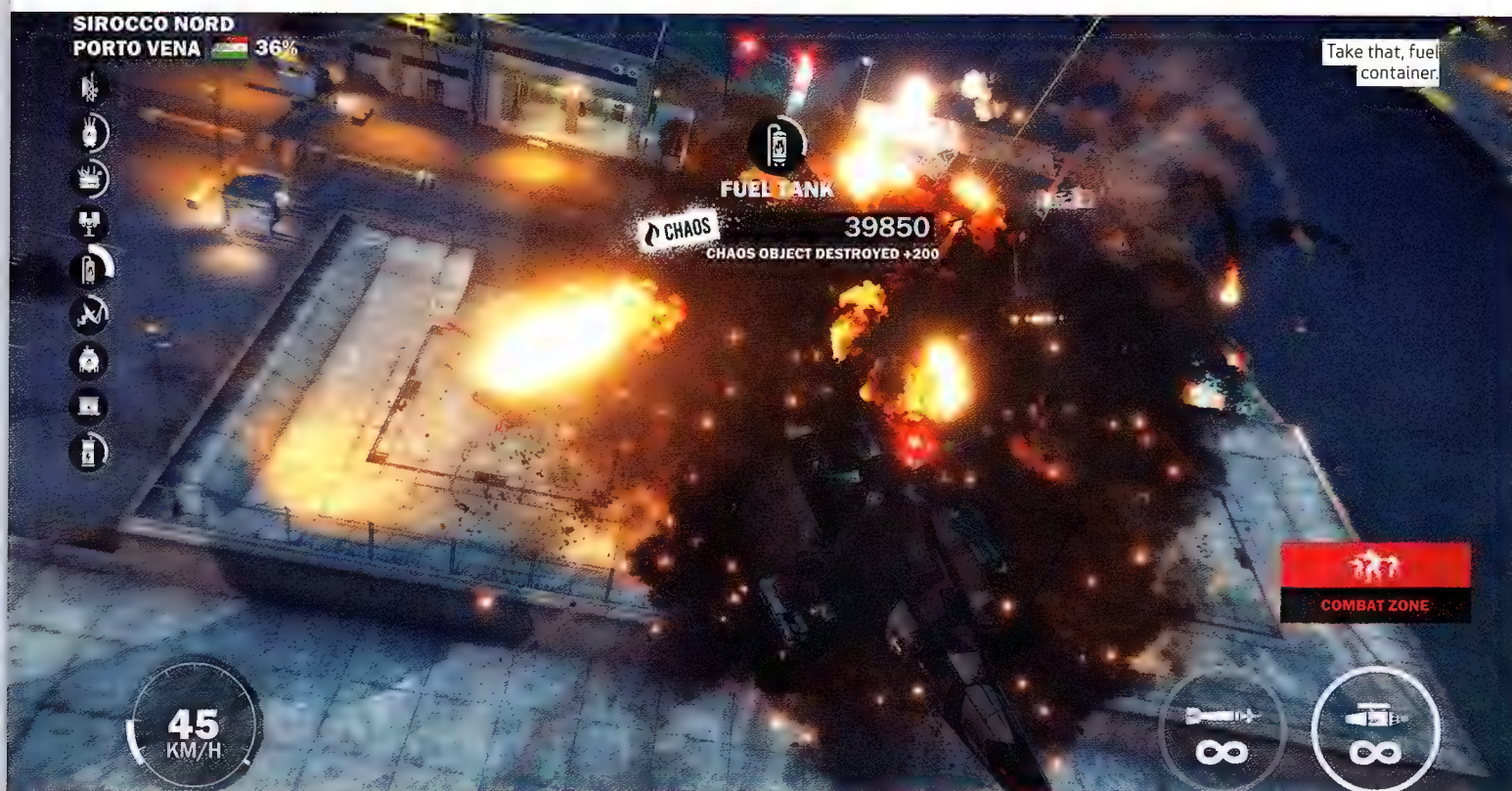
Legacy of the Void feels like a Blizzard game from another era — where the box you buy (or download) contains a wide variety of experiences and promises to sustain investment for a long time. This is a game from the universe where the RTS never went away, where they kept getting made and improved over the course of decades. I'd say "they don't make them like this any more" but they clearly do.

■ Chris Thursten

Verdict

A brilliant strategy game that manages to be broad and deep, challenging and accessible.





FROM \$79.95 | PC, XO, PS4 | WWW.JUSTCAUSE.COM

Just Cause 3

A superficial symphony of destruction.

The explosions in *Just Cause 3* are really, really good. They're elaborate, extravagant eruptions of fire, debris and smoke. And when you blow something up, the ensuing fireball spreads to other objects around it, triggering a massive, destructive chain reaction but when the fires burn out, you're left with a simplistic, strangely dull action game.

Rico Rodriguez returns as the protagonist and seems, over the course of three games, to have slowly transformed from Antonio Banderas into Nathan Drake. This time, he's liberating Medici, a chain of islands in the Mediterranean controlled by cartoon dictator Sebastiano Di Ravello. This sadistic, egotistical, medal-studded despot rules the country with an iron fist, and it's your job to dramatically blow up that fist.

Rico has always been a man who smirks in the face of

physics, but in *Just Cause 3* it's a hearty belly laugh. A new gadget, the wingsuit, lets you soar across the map, and it's brilliant. You can keep going forever by shooting your grappling hook at the ground and pulling yourself forward. It makes no sense, and is one step away from flying, but combined with the old parachute combo, moving around Medici is a blast.

Di Ravello's hold on the islands is represented by enemy-controlled towns, airports, military bases, radar installations, prisons and other establishments. The general rule is, if it's red, you have to destroy it. By reducing these areas to rubble, you win territory back for the rebels. Your ultimate goal is to take control of all of Medici and oust its dictator. A just cause indeed.

But it's not long before it starts to feel like a chore. Every enemy base has a long shopping list of objects you

need to destroy – fuel tanks, generators, radar dishes, etc. You charge around chucking grenades and launching rockets until every red thing has been checked off. This being a sandbox game, you'd think I would be able to just avoid this stuff altogether and find something else to do. There are story missions – in which you'll find some genuinely memorable, imaginative set-pieces – but they're often locked until you free a certain amount of territory on the world map. So to advance the story and see the next exciting thing, you're railroaded into blowing up red things. So many red things. It's an unnecessary restriction in a game that celebrates freedom.

Medici is massive, but there's no sense of discovery. When you see something in the distance, there's no mystery about what it might be: it's almost certainly a load of red

things waiting patiently to be exploded. It's colourful and the geography is varied, but it feels empty.

Your only real interactivity with your surroundings is destroying them. And when you destroy something, it's gone forever, removing that interactivity.

It's not a bad game: just an underwhelming one. There are moments of wonderful, anarchic chaos that make you feel like the world's coolest action hero. But that can only hold your attention for so long, and boredom soon sets in.

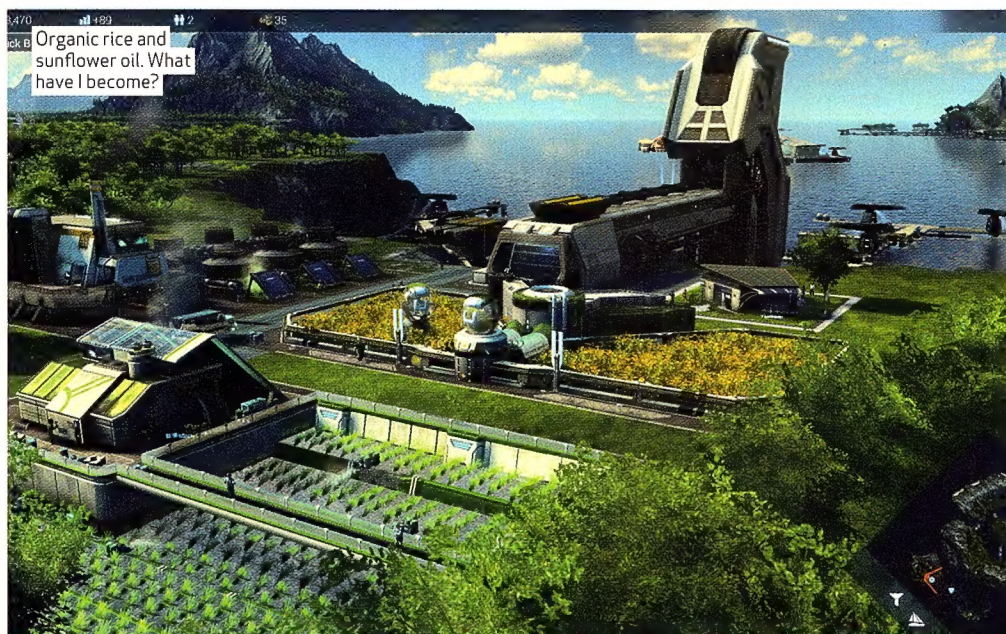
All the explosions in the world can't hide the fact that *Just Cause 3* is marred by simplistic design and an uninspiring world.

■ Andy Kelly

Verdict

The explosions are undeniably amazing and it's fun in short bursts, but *JC3* is far from revolutionary.





FROM \$68 | PC | ANNO-GAME.UBI.COM/ANNO-2205

Anno 2205

A lean city builder that aims for the moon but is a little short of rocket boost to reach it.

You can understand my terror, then, upon discovering that the entirety of my nascent megacorp's all-male workforce was made up of Liverpudlians. They were polite enough, but simmering class war would surely impact the financials — I had to gentrify, and fast.

With a spate of promotions, I transformed Workers into female Operators. Too soon, however, I'd feel the consequences of my scorn for the working classes: Anno 2205's bourgeoisie are insufferable, hardly moving in before demanding fresh fruit, vitamin drinks and, yes, organic rice. This is standard fare for the city-building series. It's a balancing act involving cash flow, infrastructure and the increasingly unreasonable desires of your citizens. There's a faint "caring for the planet" moral, although history seems on-course to repeat itself given your inhabitants' incredible propensity to consume. Cybernetics are all the rage in the temperate islands that remain after the world's sea-level rise in Anno 2070,

while the hipsters on the moon want Rejuvenators.

Ah, yes: the moon. Anno 2205 pits you against various NPC corporations in a race to colonise the moon and extract its delicious helium-3 with the long-term goal of building a fusion reactor. Supply lines must be established and maintained as a matter of priority, factoring the shipping costs into your budget. Like all city builders, it's an optimisation challenge but, on standard difficulty where money flows and workers are eager to serve, not a tough one. The Lunar Licensing Program is a step-by-step guide through the campaign that sits in your mission log alongside other 'quests' doled out by your competitors. It tells you what to build and when, leaving you to plug the funding gaps on your own initiative.

You have to be reactive rather than proactive in Anno games. Strategy doesn't come into it: you lay down some dwellings and witness the havoc they wreak upon commodity levels before improving those facilities to restore balance. There's a sub-plot to Anno's typically

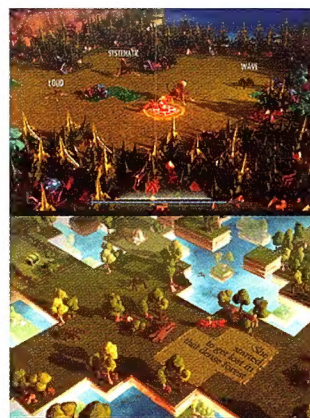
insipid RTS-lite elements in which you pilot a fleet of battleships around ice floes and islands blowing up moon terrorists and completing fetch quests for fellow CEOs. These are optional distractions for additional resources, as you can also progress by expanding your cities.

Anno 2205 does look gorgeous. This is a city builder that can easily tax your rig rendering for a level of detail that has no value in itself but still made me smile when I realised that people on the moon do hop instead of walk. This is the most streamlined, straightforward Anno yet. It's pacier and more forgiving than any other city builder, which makes it a great introduction to the genre. The balancing act lacks depth, however, and coupled with the lacklustre RTS component, it's hard to see what a Cities: Skylines veteran would really get out of it.

■ Angus Morrison

Verdict

An ideal gateway into the city management sim, but with little depth for city-builder regulars.



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If there's something that *Typing Of The Dead Overkill* didn't quite get, it's that there's more to hammering words into a keyboard than taking potshots at zombies. *Epistory* is the tale of an author who has some serious writer's block, and asks her muse to help. Playing as said muse — a girl riding on the back of a three-tailed fox — you must smash down that creative wall by exploring a world where your only weapons are words.

The beautiful *Tearaway*-style papery world is filled with treasure to loot, enemies to battle and puzzles to solve, all by typing the words required into your keyboard. Small enemies might only take a three-letter word to remove, while bigger ones will require a better vocabulary to beat. As the narrative progresses, the writer's story begins to unfold across previously blank pages, and it's all down to you and your adventures. Helpfully, if you aren't super speedy, the game even adjusts its difficulty on the fly, so there's no need to practice too many 'quick brown fox' reps. It's already playable on Steam via Early Access, but the dev team is planning more dungeons, extra puzzles, a complete story, and arenas with leaderboards so you can challenge your friends. RSI, here we come. ■



FALLOUT 4 LAUNCH SIGNIFICANTLY DENTS PORNHUB TRAFFIC

Which is absolutely a 100% coincidence. Yep.

At 9am GMT on the 11th of November, *Fallout 4* — the most anticipated game of the year — became available to a swathe of eager gamers across the world. In the dead of night, players stumbled out onto the Boston wasteland and into a stark world of radioactive possibilities. Meanwhile, website Pornhub experienced a massive decline in its online traffic and remained that way for the next 11 hours. According to a graph released by the online service, fans of sports, action, adventure and strategy games were the largest groups to desert the site during those hours. Pornhub's Corey Price admits, "We can't blame anyone for swapping Pornhub time for some Pip-Boy surfing instead. We would have done the same."



Selfie sticks might suck, but this idea is worse

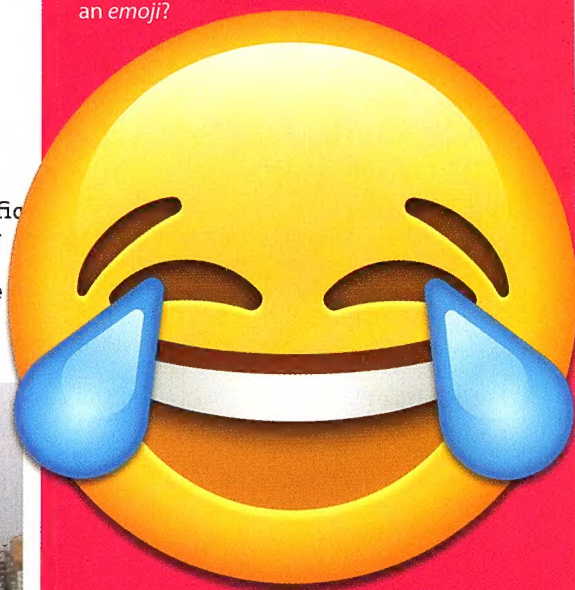
THE TONGUE-IN-CHEEK INVENTION TO COMBAT SELFIE STICK EMBARRASSMENT.

The act of people taking selfies has gone quickly from bemusing to annoying for a lot of people. Because of this, surely the photographers themselves would wish to avoid the embarrassment of whipping out a selfie stick and facing the scorn of all those onlookers, jokes inventor Mansoon. But that shot still has to be taken and there's no way they're going to ask someone to take a photo for them. Mansoon's solution to this first-world problem is to make his arms longer via a selfie-stick-like contraption concealed in extra long sleeves, ending in a pair of plastic hands to which your phone can be connected. The resulting photos are equally as strange, but at least *he* feels unembarrassed.

Binge-watch with tears of joy

TECH DOMINATES DICTIONARIES'
OFFICIAL 'WORD OF THE YEAR' PICKS.

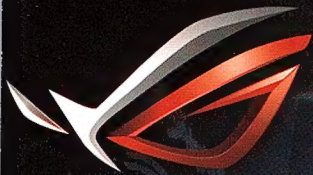
Early in November, Collins Dictionaries named its Word of the Year 'binge-watch' due to the snowballing consumption of on-demand streaming services such as Netflix and Stan, and how easy it can be to sit and watch episode after episode of the newest series. While this word choice was not embraced by all, 'binge-watch' is at least a word — unlike what Oxford Dictionaries chose as its Word of the Year. The 'Face with Tears of Joy' emoji (seen below), according to Oxford, achieved its position on top due to it being the "most used emoji globally in 2015". Their rationale is that an emoji or pictograph is shorthand for expressing sentiment through words. Makes sense, we guess. But still... an emoji?



Making it 'Facebook official'

FACEBOOK WILL NOW HIDE YOUR
EX'S UPDATES.

In a blog post, Facebook's product manager announced that the company has developed a tool to "help people end relationships on Facebook with greater ease, comfort and sense of control". After a breakup, there comes a time when you have to change your relationship status and face the barrage of questions and sympathy on your wall in reply. The social media now gives you additional options to filter content from your ex — assuming you haven't already unfriended them/vowed never again to speak their name — including limiting how much you see of your ex and how much they see of you on their news feed. Um... like? ■



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